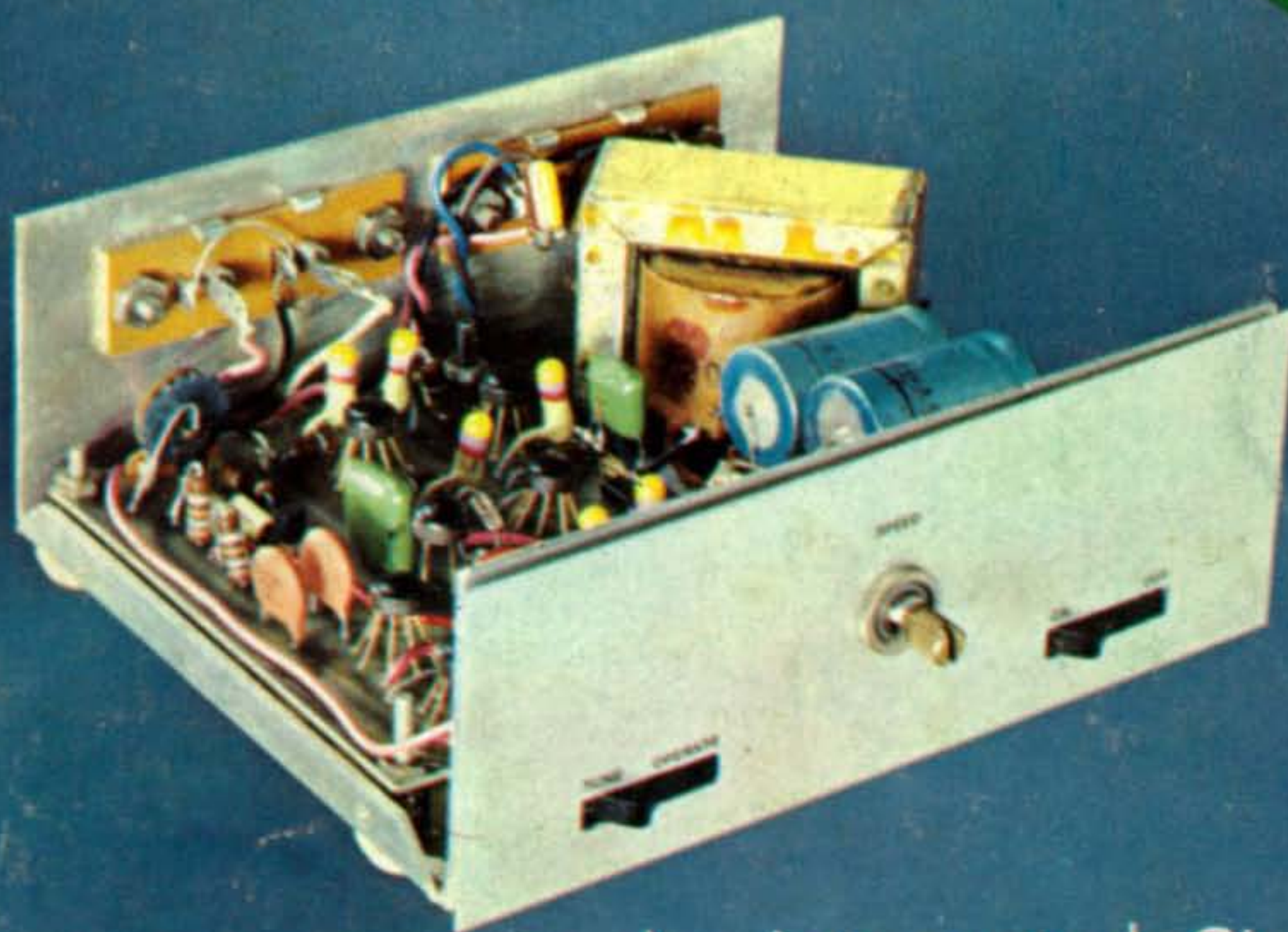




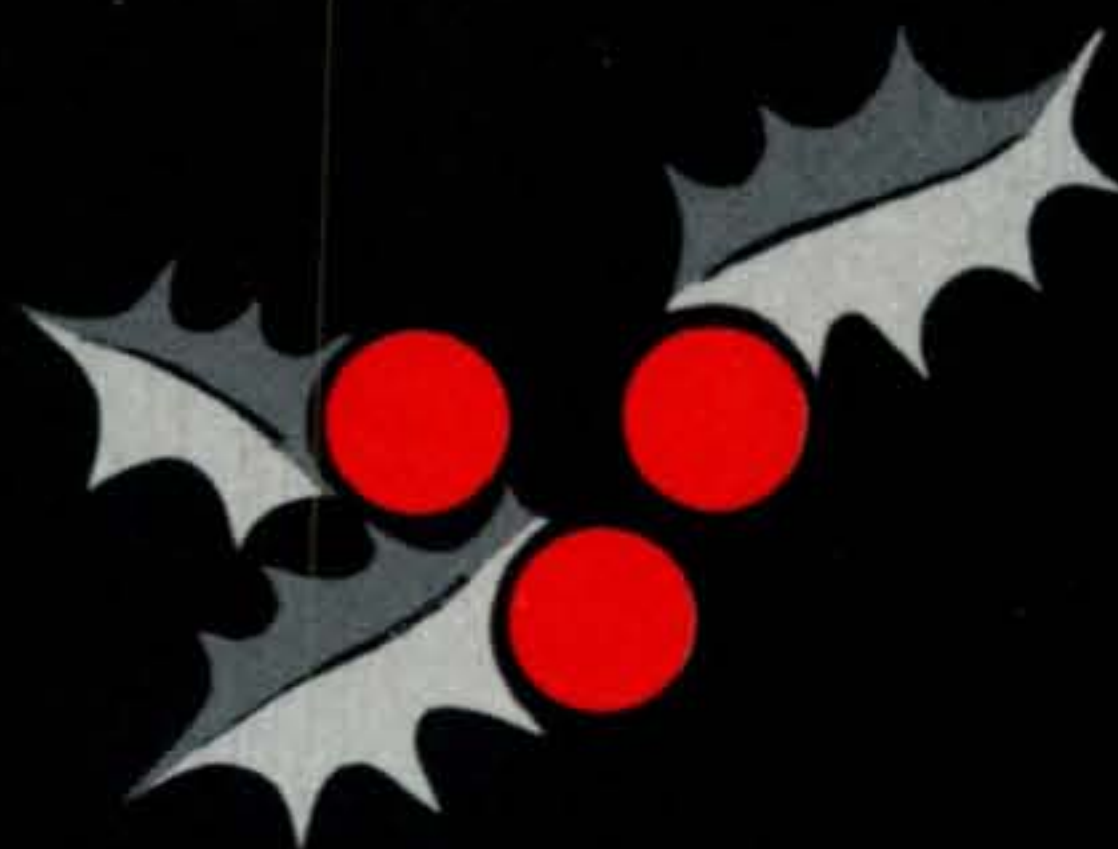
December 1967
75¢

Season's Greetings



An Integrated Circuit
Electronic Keyer

The Radio Amateur's Journal



Meet The Dividers!

ICD SERIES INTEGRATED CIRCUIT DIVIDERS

They are new from International. Use them for crystal controlled time bases, scope calibrators, and clock sources.

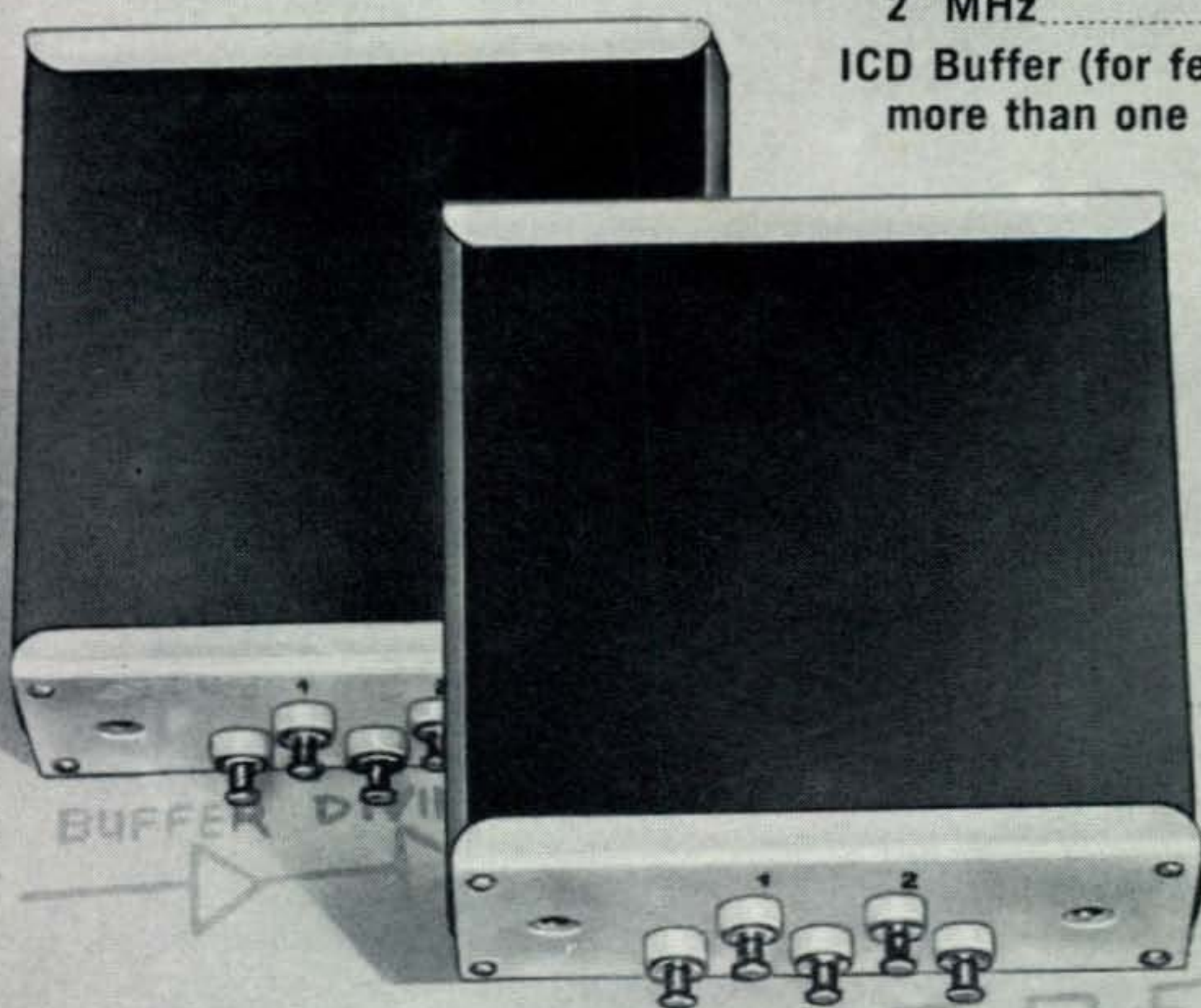
International ICD units are totally integrated circuit frequency dividers. They are smaller than a pack of cigarettes (1" x 2¼" x 2⅜"). All have two separate outputs. They are packaged in nine types providing divide ratios 2 thru 10. No tuning or adjustment is required. The output pulse has the same stability as the driving pulse. Voltage required, 3.6 vdc $\pm$ 10%.

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ICD-10 to 10 MHz.....\$19.95 ea.

ICD-2 thru ICD-9 to
2 MHz.....\$19.95 ea.

ICD Buffer (for feeding
more than one circuit)...\$ 9.95 ea.

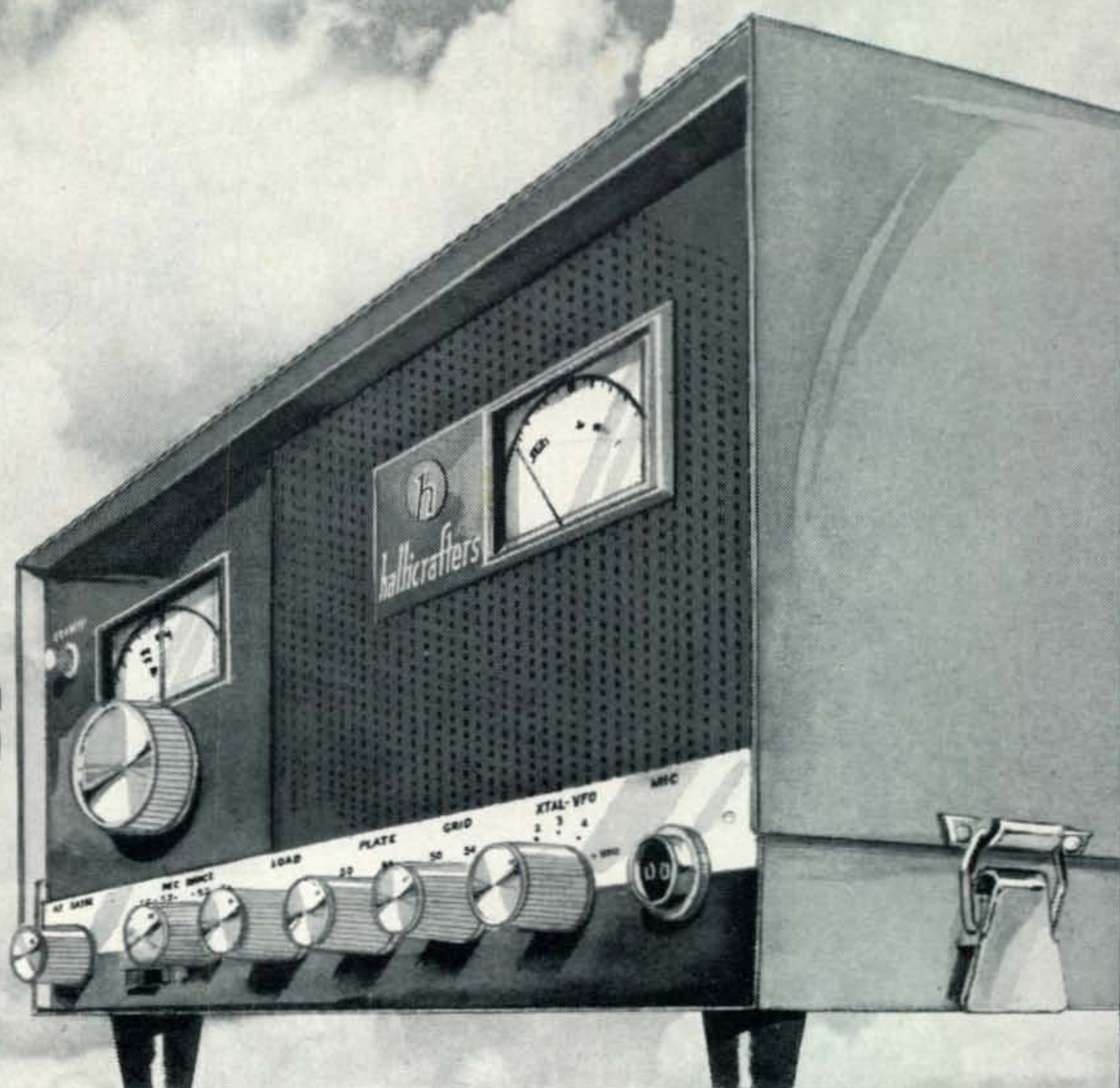


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FEATURES

Frequency Coverage: 50 to 52 Mc and 52 to 54 Mc (144 to 146 Mc and 146 to 148 Mc in the SR-42). **Power Input:** 10-12 watts. **Power Supply:** 115 VAC and 12 VDC (vibrator and line cord optional extra). **Transmitter Crystals:** high frequency type; provision for four (one furnished), plus external VFO, switch-selected from front panel. **Tubes:** 10, plus zener diode oscillator control and four diodes (11 tubes, 2 zeners and four diodes in the SR-42). **"S" Meter** automatically switches to RFO. **Cabinet:** "snap-off" type for easy access. **Size:** 5½" high, 12½" wide, 8¼" deep. **Shipping Weight:** 17 lbs. **Amateur Net Price:** \$199.95



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SR-46A

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**The Radio Amateur's Journal****TABLE OF CONTENTS**

THE INTEGRATED KEYS	Jack Burchfield, W8CRD	12
CQ REVIEWS: THE HEATHKIT HW-16 NOVICE C. W. TRANSCEIVER	Wilfred M. Scherer, W2AEF	18
A 25 KC MULTIVIBRATOR	Wilfred M. Scherer, W2AEF	26
THE J ANTENNA ON 6 METERS	Byron H. Kretzman, W2JTP	29
MINIATURIZED RECEIVING AND TRANSMITTING ANTENNAS	John J. Schultz, W2EEY/1	33
A 3.5 MC VACUUM TUBE V.F.O.	Ed Marriner, W6BLZ	40
PROJECT MOONRAY: PARAMETERS ANNOUNCED		44
DESIGNING AND BUILDING A FIVE BAND INDOOR ANTENNA	Harry Lowenstein, W2HWH	46
NEW AMATEUR PRODUCTS		48
GRUMBLES	Sam	50
FIRST QUAD	William E. LaFarra, W5ZCC	51
DXING THE GALAXY ON 633 X 10 ⁻¹⁰ METERS	James A. Gupton, Jr., W4AML	56
A POOR MAN'S 6 METER SPECIAL	Sam Kelly, W6JTT	66
A SMALL SIGNAL TRANSISTOR TESTER	William M. Turner, W4MND	70
VISITING FIREMEN AND THE GOOD OLD DAYS	Sylvia Margolis	75
CQ REPORTS ON: THE ANNUAL RADIO-ELECTRONICS CONVENTION FOR THE BLIND	Alan M. Dorhoffer, K2EEK	80

DEPARTMENTS

ANNOUNCEMENTS	8	PROPAGATION	92
CONTEST CALENDAR	89	SCRATCHI	9
DX	84	SURPLUS SIDELIGHTS	102
OUR READERS SAY	6	USA-CA	98
ZERO BIAS	5		

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A question only serious hams should answer...

by Jack Quinn, W6MJG

How come you are still asking for our obsolete book? The one called "The Care and Feeding of Power Tetrodes." Look, we've already mailed out over 100,000 copies of the thing. It's just got to be in the hands of every amateur who ever went on the air. Don't get me wrong, I'm happy you find it useful. But now you should be asking for our *NEW* book, "The Care and Feeding of Power Grid Tubes."

It so happens that right now on my desk is a pile of these new books. They're really pretty interesting. You see, one of the fellows on our staff—Bob Sutherland, W6UOV—took it upon himself to incorporate the answers to over 400 questions asked of us in a year's time. In fact, he has spent just about every spare moment away from his shack, preparing this new pocket-size book. I couldn't believe that it has almost 200 pages. Bob said he just got carried away. He has expanded the original book, which we published back in '46, so that in its new form it covers all types of power grid tubes in RF and AF

service. Even has graphs and things like that.

Now you're probably wondering, where can I get it? Thought you'd never ask. Right this minute there is another pile of these books at your nearest Eimac/Varian distributor, or your favorite technical bookstore. Figuring all the time we've spent in getting them ready for you, they're really a bargain at \$3.95 each. If it's inconvenient to get to the distributor or the bookstore, write me, and I'll send your request along to the book retailer.

In fact, if you are among the first 50 hams to write me, I'll send you one free. Can't beat that.

Jack Quinn
Division Marketing Manager



Division of Varian
San Carlos, California 94070

New Readers Service on Page 120



ZERO BIAS

THE EIA, (Electronics Industries Association), a long-standing reputable association of manufacturers in the electronics industry, has after many years established a special section devoted exclusively to amateur radio and its problems.

What this means to ham radio will be told only in years to come, but for the moment, it means that amateur radio now has a new strong organized voice, backed by many dollars and populated by some of the most knowledgeable and dedicated men in the business. It means that the amateur radio industry will have the strong public relations arm of EIA at its disposal to publicize the hobby from an industry point of view. It also means that amateur radio may now enjoy uniform standards of performance and quality which have long been needed.

One thing that it might mean (and we've mixed emotions about this), is that now a solid front of loyal opposition to ARRL can be mustered when the state of affairs so demands. One such situation might have been the late incentive licensing battle, although the final outcome would have probably been the same. The fact remains that the long-needed "second voice" in amateur affairs seems to be appearing.

But what assurance do we as individuals have that this "commercial" organization will not use its powerful position for the benefit of itself, at the expense of the amateur and his feelings? We have two: 1—The men who comprise the Amateur Section of EIA are themselves amateurs who have gotten their start through amateur radio, and who—to a man—have a love and devotion to their hobby that is unsurpassed. They are businessmen, but first, they're amateurs. 2—All three of the US amateur radio magazines have been invited to join EIA as non-voting associate members, thereby opening the inner workings of the section to public discussion, and when necessary, criticism. At press-time *CQ* was the only one of the three to accept the invitation. In our role as a free-press observer, we hope to assist EIA to keep the needs and desires of the individual amateur in mind.

One of the early moves by the Amateur Section of EIA was in the establishment of a Technical Standards Committee to (among other things) recommend to manufacturers what minimum standards of performance are to be expected from various amateur equipment, and to establish uniform methods of evaluating equipment performance.

The second interesting move was the decision to oppose the FCC Proposed rule making

Docket #17736 regarding permitting Slow-Scan TV on the h.f. bands, specifically, in the Advanced and Extra Class portions of the 80, 40, 20 and 15 meter phone bands. The original ARRL petition suggested Slow-Scan TV in the 10 and 15 meter phone bands. The FCC in its Docket 17736 states, however, that due to "the advanced techniques required and the expectation that comparatively few amateurs will use this mode" it is proposed to limit slow scan TV below 50 mc to only the Extra and Advanced Class voice sub-bands. We concur with EIA's feeling that these sub-bands should not be subject alone to Slow-Scan signals.

However, EIA goes on to request that the c.w. portions instead be used for slow-scan TV. We strongly disagree. A slow-scan TV signal is an a.m. signal with a potential 6 kc bandwidth. Six-kilocycle-wide signals with steady carrier have no place in the c.w. bands, whereas they would create no more interference to phone-band operation than would *any* a.m. signal. Further, to exclude General Class operators from using this mode of communication is unnecessarily restrictive and does not further the progress of amateur technology; it hinders it, without question.

The Amateur Section of EIA *will* not be flawless in its performance. It *will* make mistakes. But it can be a strong positive force in the further refinement and development of amateur radio. It has our support.

CQ To Raise Subscription Rates

Well, I suppose it was inevitable. For months we've been fighting to keep the subscription rates from going up, despite growing costs. After increasing the number of pages and drastically improving our format, we still kept *CQ* at \$5.00 per year. Unfortunately, the postal rate increases and another printing raise have dented the camel's back.

Effective March 1st, *CQ's* rates will be \$6.00 for one year, \$11.00 for two, and \$15.00 for three years. We're giving all readers 90 days advance notice to allow them to get in at the old price. So, if you've been procrastinating it's time to move. Get your sub in before the rate hike.

Incidentally, this is *CQ's* first subscription increase in eleven years, while the other mags have raised their rates two or three times each, so we haven't been doing so bad by our readers.

Our Cover

This month's cover shows a first-rate electronic keyer using integrated circuits. W8CRD, Chief Product Engineer at Electro-Voice is the builder. Our thanks to the advertising department at Electro-Voice for the fine color shot as well as the article's photos. Last month's cover shot, incidentally, was supplied through the courtesy of RCA.

73, Dick, K2MGA

OUR READERS SAY

First BC Station

Dear Dick:

I read Part I of Howard Pyle's article on "Electronic Careers" with a great deal of interest and I am looking forward to the rest of the series. The article appealed to me, not only because it reminded me that my interest in amateur radio—30 years ago—was the beginning of my career in the communications field, but also because of the history of radio that Howard retells.

As have other writers before him, Mr. Pyle seems to credit KDKA with being the world's first commercial broadcasting station. In 1945 the National Association of Broadcasters decided that Station WWJ, owned by the Detroit "News", began broadcasting ten and one half weeks before KDKA. Of course, in those days it was difficult to distinguish between amateur and commercial operation!

For the benefit of other radio history buffs, I would like to mention a book that was published by the Harvard University Press in 1946. The author is William Peck Banning and the title of the book is "Commercial Broadcasting Pioneer". It covers the early patent licensing arrangements, the development of the concept of "broadcasting", experiments with WBAY, WEAJ and other stations, network evolution and many other interesting aspects of radio in those early days. While the book is now out of print, it can be found in several libraries and private collections.

George Schleicher, W9NLT
Deerfield, Illinois

Old-Time Novices

Editor, CQ:

I have an Amateur Extra Class license, and have for many years trained and given the Novice Class license. It has been my experience that most of these Novices never have been able to pass the 13 w.p.m. at the end of the one year license period. Most of the Novices I have worked with, however, have been in the 65-80 year old bracket, and whose fingers no longer can push a pencil to write 13 w.p.m. The Novice license to these old timers has been most enjoyable giving them something to do with their time. Most of them are not interested in phone operation and would be happy to continue to operate only on 80 meter c.w. where there is little QRM.

It seems to me that elder citizens in our society, should, after 65 years of age be given extended Novice licenses to permit them to continue to operate indefinitely in the 80 meter Novice band. What harm can it do? This is one privilege which would give them a sense of belonging to our society.

Many of these old timers I find had an early interest in wireless before 1917 in the old spark days, and have no interest in v.h.f. phone bands offered them as Technicians at the end of their Novice period.

I suggest we consider this aspect of the Novice license, and perhaps in time, gain more amateurs rather than losing them at the end of the Novice period.

Ed Marriner, W6BLZ
La Jolla, California

New Look

Editor, CQ:

The last few months I have been comparing the content of CQ and 73 and have come to the conclusion that I prefer CQ. Incidentally, your new color and format style has influenced my decision. I enjoy DX and Propagation columns but do not care much for articles like Grumbles, Scratchi, etc. I prefer technical discussions, equipment descriptions, operating practices, art of QSLing, etc. Infrequent descriptions and pictures of out-of-the-way places are welcome, but in general, foreign operation should be by foreign operations, not so-called DXpeditions by subsidized U.S. operators.

Why don't you drop columns like Grumbles and other *chaff* and replace them with a primer series plus Novice education.

Keep up your support of ARRL but don't be afraid to give the facts. That a few of the top amateur equipment manufacturers fail to advertise in your so-called competitor should mean something important to you.

R. J. Cassuit, K6VJE
LaMesa, California

Editor, CQ:

As a longtime CQ subscriber—10 years now—I just want to thank you and congratulate you for the large amount of effort and expense it obviously took for your completely new look. The August issue is the best yet. In case you've been wondering, we readers do appreciate the result.

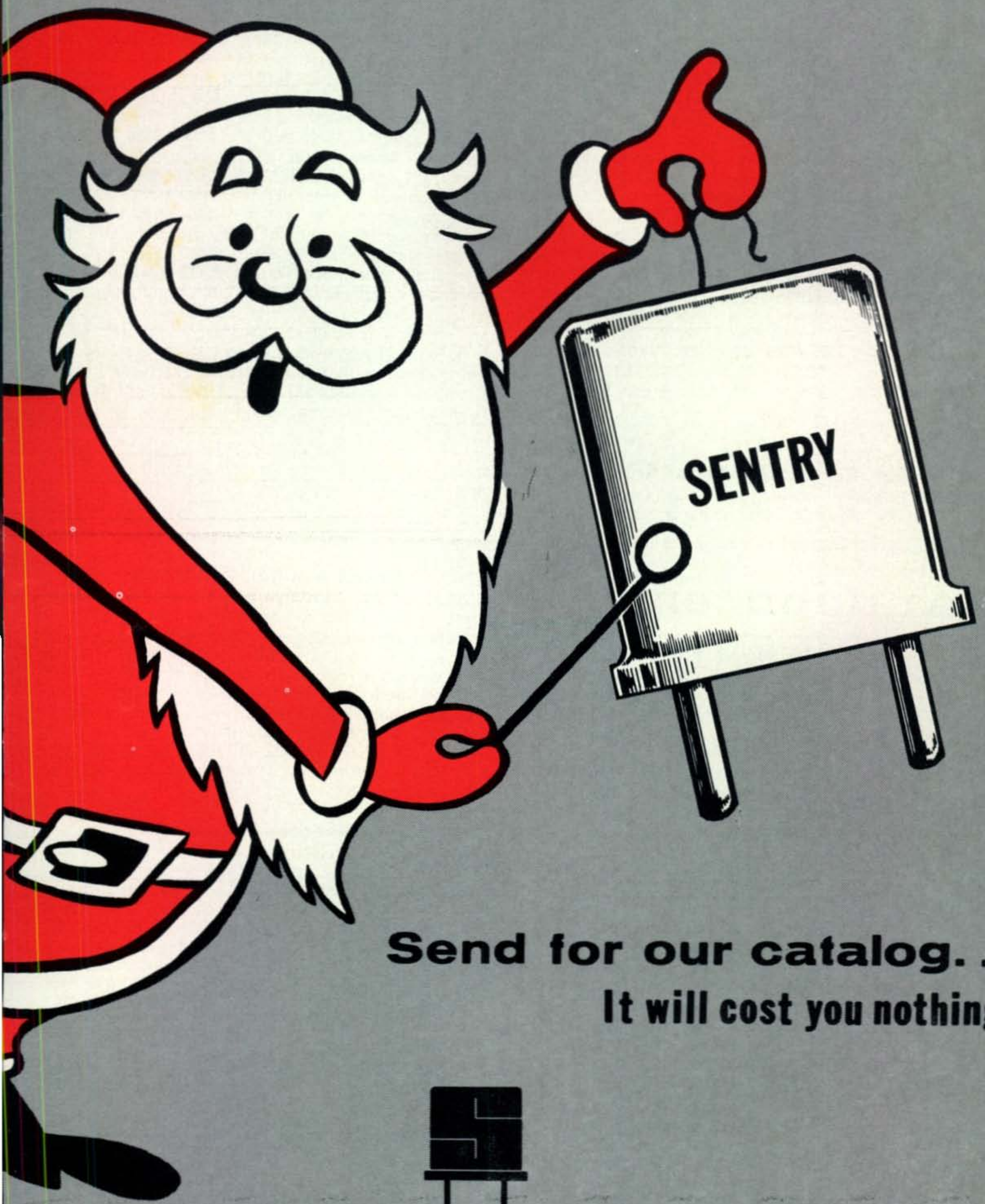
Sumner Weisman, W1VIV
Framingham, Mass.

Better Use of 10 Proposed

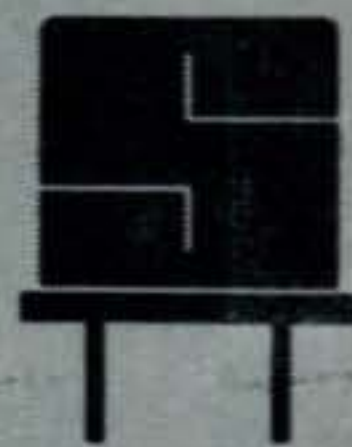
Editor, CQ:

As a keen ten meter operator I have often been wondering why the FCC still maintains a division of c.w. and phone frequencies on this band that must be classified as absolutely obsolete. Before the advent of s.s.b. the frequency allocation on 28 mc was well justified by the fact that overseas phone stations could be much better received when they were using another portion of the band than the United States stations, so W hams were transmitting above and listening below 28.5 mc. Today the situation is a different one. Transceive operation on s.s.b. and the necessity of quick calls make it self-evident that most contacts are carried out with both stations on the same frequency. Many s.s.b. rigs only cover part of the ten meter band, usually 28.5-29 mc. s.s.b. operation below 28.5 mc by European stations is a rarity. Although some countries (including my own) only give the c.w. stations 100 kc for their exclusive use, most radio amateur societies around the world seem to agree on allotting 200 kc for exclusive c.w. work, with phone operation from 28.2 to 29.7 mc. Even during contests two hundred kilocycles is a sufficiently large band segment for c.w. and it seems much wiser to leave more room for the a.m. stations. Ten meters is the only remaining retreat for the rather suspect types who insist on using a.m. (yes, I'm one of them). As the situation is now the large number of U.S. stations using a.m. are usually to be found above 28.8 mc because the first 200-300 kc of the US

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phone band are crowded by s.s.b., particularly at weekends. With more and more sidebanders on ten, the a.m. stations will be pushed away higher and higher in frequency, being the weaker part who will have to budge. Now to my proposal: why not allow US phone stations to use also 28.2-28.5 mc. The ten meter band is not often open to widely separated parts of the world at the same time, so European stations wanting to work Africans or Latin Americans on this portion of the band will be able to do so in the future too without too much additional QRM. The s.s.b. stations will find it easier to spread out instead of congesting just above 28.5 mc. Another suggestion would be to put most of the local nets around or above 29.0 mc, a practice already in use in Eastern Europe.

Here we have an excellent band of great use in DX as well as local amateur communication which will become increasingly popular during the next few years. It's high time to change the obsolete band plan before we get a QRM problem also on ten. With wise provisions, however, there will be quite enough room for all modes, including a.m.

Ullmar Qvick, SM4DXL
Editor, *QUAX*, 28 mc News-sheet
Sweden

For Reciprocity With Antigua

Dear Editor:

Wonder what the Ham fraternity can do to en-

courage the FCC to encourage and exploit the reciprocal agreement between nations for the operation of amateur radio stations?

Here in Antigua (which just gained independence) no such agreement exists—leaving a number of potential VP2's off the air. With the advent of the Apollo program, deep space stations, troposcatter installations, etc.,—and many of which are staffed by Hams, the lack of such an agreement forces many of us to deny the DX hunters a much sought after contact!

I am sandwiched in between a Quad on one side and a 3 element Yagi on the other—both abandoned for lack of being able to become licensed. (The hams have since left the island and the current tenants have no idea of what good use these antennae could be put to!) I'm pretty certain that this condition exists in other areas, also.

Perhaps an editorial bringing this matter to the attention of all Hams would cause enough interest to have them bring pressure to the powers that be and effect a remedy to this badly neglected situation. When I accepted this assignment I was under the impression that a reciprocal agreement existed but am now trying for either Madrid or the Canary Islands—possibly even back to Guam as KG6A----

I have no idea as to the mechanics involved to achieve this end and must request to remain anonymous but I am sure your efforts would be much appreciated by the entire amateur fraternity!

Name Withheld By Request

Announcements

Whole Blood Needed

The wife of Lew Goldberg, WB2SSM is in need of at least 20 pints of whole blood to replace that used in a serious surgical procedure early in December. Whole blood taken from a Blood Bank must be replaced in the name of the patient or his family within 90 days after its use, or a \$35 per pint fee must be paid. Readers interested in aiding a fellow ham are urged to make their donation at any Red Cross Blood Bank Station anywhere in the U.S., asking that it be credited to the account of Lew Goldberg, WB2SSM at Massachusetts General Hospital.

Oakland, California

A new amateur association was recently formed in Oakland, Calif., namely, the National Amateur Betterment Association. Bob Grimm, K6RNQ was elected to the post of Chairman. The basic purpose of N.A.B.S. is to act as a spokesman for all amateurs. Anyone wishing more information about N.A.B.S. may contact Bob at 155 Kinder Lane, Pleasant Hill, California 94523.

Cabot, Arkansas

The A.M. International net was started Sept. 18, 1967 with 9 stations checking in and this has been increasing each day. It now has 35 stations on the roll call. The A.M.I. net covers 9 states, including Ala., Ark., Ill., Kansas, La., Okla., Mo., Tenn., and Texas. For further information on A.M.I., contact the manager, Russ Parks, WA5OSC, Box 42, Rt. 2, Cabot, Ark. 72023.

Baton Rouge, Louisiana

Sunday, Dec. 3 through Sat. Dec. 9, has been set aside by the Baton Rouge Amateur Radio Club to celebrate their 150th year. The club will award a certificate to anyone making contact with a Baton Rouge Club member during this week. You may use any mode and any frequency. To receive your Sesquicentennial Certificate, send a large, stamped, self-addressed envelope to Baton Rouge Amateur Radio Club, P.O. Box 53194, Baton Rouge, La. 70805. Remember, it must be a club member only.

Wheaton, Illinois

Hams, CBers, electronic hobbyists, friends, and commercial exhibitors are cordially invited to the Wheaton Community Radio Amateurs Sixth Annual Mid-Winter Swap & Shop on Sunday, Feb. 18 at the DuPage County Fairgrounds, Wheaton, Ill. Hrs: 9 A.M. to 5 P.M. \$1.00 donation. Refreshments and unlimited parking. Free coffee and doughnuts from 9 to 10 A.M. Contact Ken Bourne, K9GHR, 305 Maple St., Glen Ellyn, Ill. 60137 for further information.

Provo, Utah

On Saturday, Feb. 17, 1968, a "Hamvention" will be held by the Utah Council of A.R.Cs. at the Utah Technical College in Provo, Utah. The event will include prizes, a tour of the electronic and other facilities at the college. Plus specialized group discussions on VHF, DX, ARPSC, MARS, etc. A special program will also be available for the ladies, and entertainment for the youngsters will be provided. Registration will be at 9 A.M. on the 17th, but pre-registration is requested. For complete details, contact Bryce K. Anderson, K7SAI. 445 North 300 East, Pleasant Grove, Utah 84062.



Feenix, Ariz.

Deer Hon. Ed:

If you not buleeving that the Hon. Yewnited States is a land of opportunity, all you having to do is reeding the magazines and newspapers. Gracious to goodness, once a person getting a good idea, he can going into business and making his forchun almost overnight.

Like taking news report I reeding in magazine cupple days ago. A company is being formed to measure television viewing habits by installing a radio reseever in the middle of a city, and having it listen on the TV channels for the signals put out by the oscillators of the TV sets themselves.

Natchyourally the TV set oscillator putting out a different freakwency for each different TV channel it tooned to, so by seeing how strong the signal strength is on each channel, it's easy to telling how many peeples have TV sets tooned into each channel.

Once you knowing that, you can publishing report that eleventeen millyun peeples watching "Agent 2 $\frac{3}{4}$ " while only cupple millyun are watching "The Savage West"—or whatever TV programs happening to be on that time period.

Of coursey, you not ackchewally heering signals from eleventeen millyun TV oscillators, but you take what numbers you have, and projecting your sample to total number of peeples with TV sets, or something like that.

This sampling idea not new, but up to now it being done by having recording meters on TV sets, or having TV viewers keep log on what they looking at.

This new idea pretty slicky, on a cct. a much larger sample can be taken. This new company figyuring it can check maybe 5000 sets in a city. So, if having set-up like that

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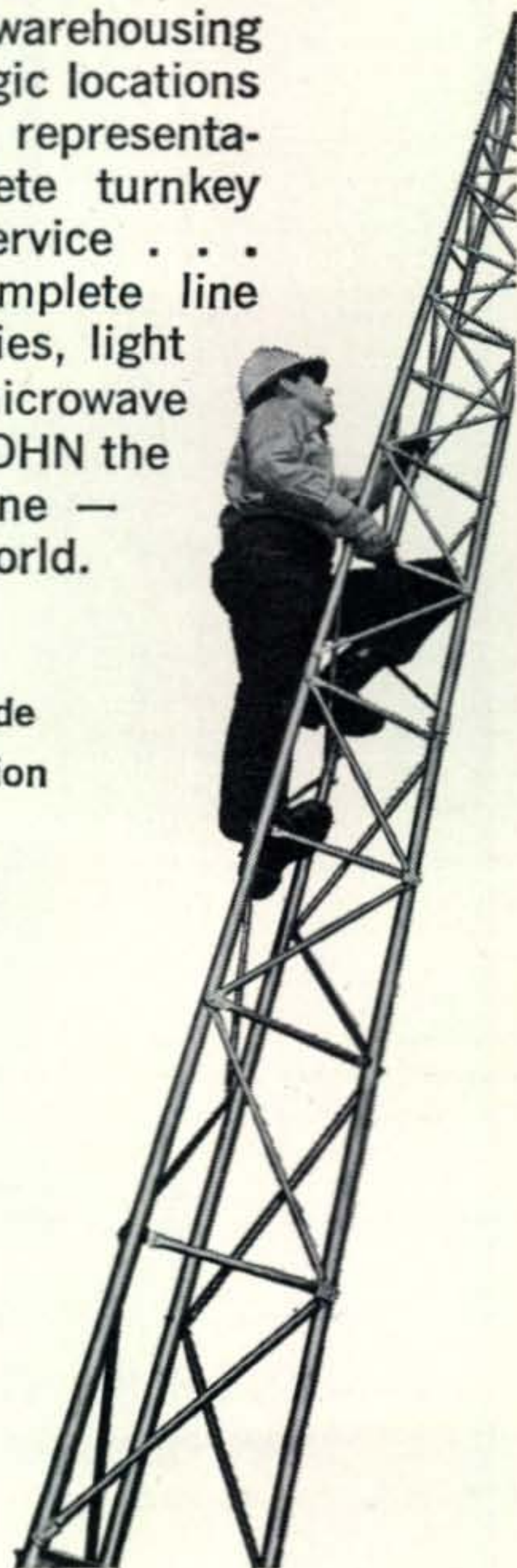
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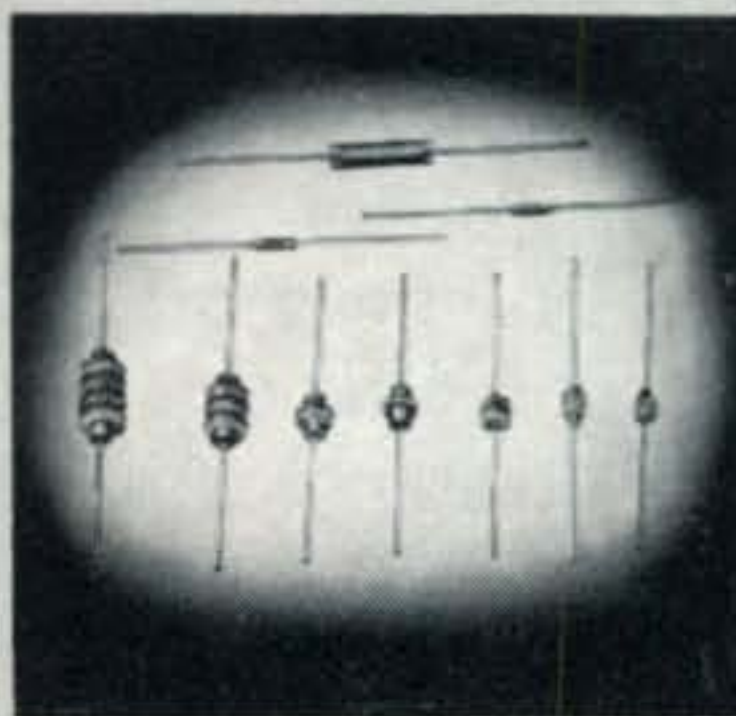


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20 Meters	34300-100	.51
40/20 Meters	34300-500	.51
80 Meters	J300-360	.83
80/40 Meters	34300-1000	.51
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LOW FREQ.	J300-1500	.83
ALL BAND	34300-2500	.51



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25035-E	4.4 - 35.0 pf	2.54
25009-S	1.6 - 9.3 pf	1.60
25012-S	1.9 - 12.8 pf	1.71
25015-S	2.2 - 15.7 pf	1.71
25025-S	3.0 - 25.5 pf	2.11
25035-S	4.0 - 35.8 pf	2.34
25009-T	1.6 - 9.3 pf	1.60
25012-T	1.9 - 12.8 pf	1.71
25015-T	2.2 - 15.7 pf	1.71
25025-T	3.0 - 25.5 pf	2.11
25035-T	4.0 - 35.8 pf	2.34



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in 100 cities, they can finding out what a half-millyun peeples liking on TV at any one time.

So now, Hon. Ed., you seeing what I saying about being in a land of opportunity? No, I not talking about the company that putting those reseeverers in a hundred cities. No indeedy, I talking about the opportunity for any amchoor who living in one of those cities who wants to make a cupple bux.

How he doing this? Very simple—he going in manufacturing business. First he investing in a cupple dozen used TV tooners, as a starter. He mounting each one in little metal cabinet, along with power supply for tooner, and adding on-off switch.

After this being done, he taking small ad in local newspaper, telling peeple that they can buying gadget to help keeping their favorite TV program on the air—only \$19.95. When peeple calling telephone number in ad, amchoor making appointment for demonstration.

He calling on TV viewer, and making explanation of how this company are measuring signals from TV set oscillator. He then plugging in gadget, and showing, how, when it tooned to any channel and turned on, it making like TV set and putting extra signal on air. Measurement survey reseever heering signal and thinking more TV sets are tooned to that channel.

So, when TV viewer liking program, he turning on gadget, and he giving extra vote for that particular program.

This gadget should selling like Hon. Hotcakes on acct. most TV viewers are nuts about their favorite programs. My first bout with TVI are teeching me that.

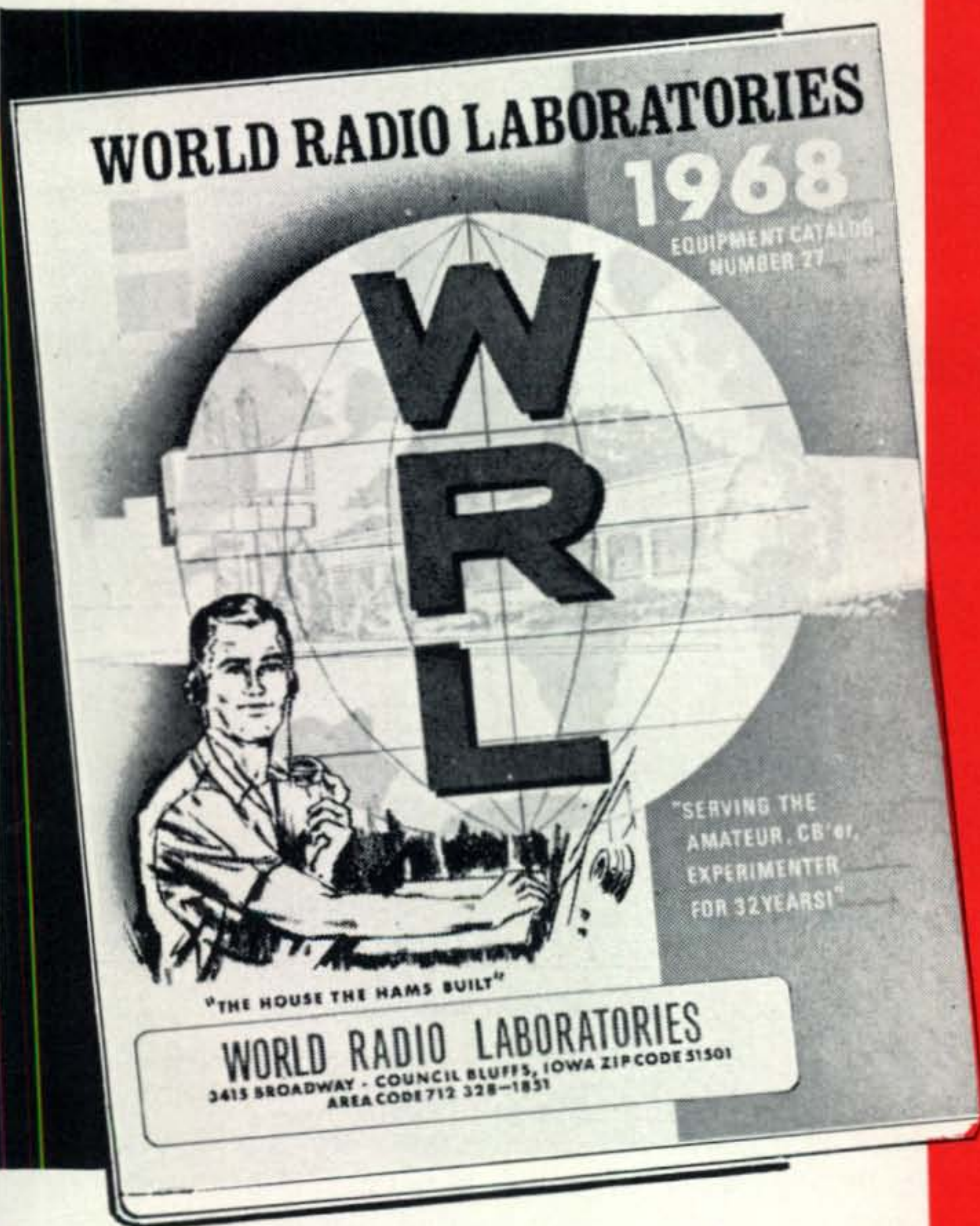
Hon. Ed., aren't that reel slicky idea!! Scratchi working on circuit rite now, and I think I finding way to making gadget sounding like ten TV oscillators in strength, without exceeding radiation spec of Hon. FCC. Maybe amchoor can getting up to \$29.95 for this kind sooper model.

So, telling your reeders to finding out if their city going to have one of these measurement services in it, so they can getting reddy to cash in on the bux.

As soon as finishing design, I rushing you detales post-hasty, so you can publishing article in your Hon. Mag. Having nice Christmas.

Respectively yours,
Hashafisti Scratchi

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BY JACK BURCHFIELD, *W8CRD

Below is the description of an electronic keyer using digital integrated circuits. The use of these IC's permits the complete package to be built on a 3" × 4" printed circuit board with room to spare and at an extremely nominal cost.

TRANSISTORS began replacing tubes some time ago in quite a few ham circuits. Then field effect transistors replaced pentodes, and now a combination of transistors and resistors on one silicon chip, called an integrated circuit, is available to the amateur quite inexpensively. They are being manufactured in two basic groups, linear and digital. The digital group is made to order for the construction of a variety of electronic keyers at a cost substantially below discrete components. Quite a few different digital circuits are available but for a keyer the J-K flip flop and dual two input gate are all that is needed. They are available from several manufacturers and recently appeared in an epoxy case at a sizable cost reduction.

Several months ago a keyer was constructed along the lines of the Ultimatic.¹ This keyer provided a dit and dah memory,

and dual paddle control for "squeeze" formation of the characters. By squeezing the paddles, alternate dits and dahs would be sent. With this method, formation of quite a few characters can be made without a back and forth motion of the paddle.

The memories insure complete characters without dropping a dit or a dah if the operator's timing is off. In addition, a free running time base was used to help spacing between letters and words. This means that when the paddles are closed, the character doesn't start until a pulse from the time base passes through the gate. While this method does produce near perfect code, it makes the timing of two or more dits very difficult.

The keyer was about to be redesigned with a gated time base when the price dropped on the integrated circuit modules. A new keyer was designed using a gated time base, integrated circuits, dit and dah memory, and retained the squeeze formation of characters.

*1005 Chippewa, Buchanan, Michigan 49107.

¹ Kaye, J., "The Ultimatic"—The Key With A Memory," *QST*, February 1953, p. 11.

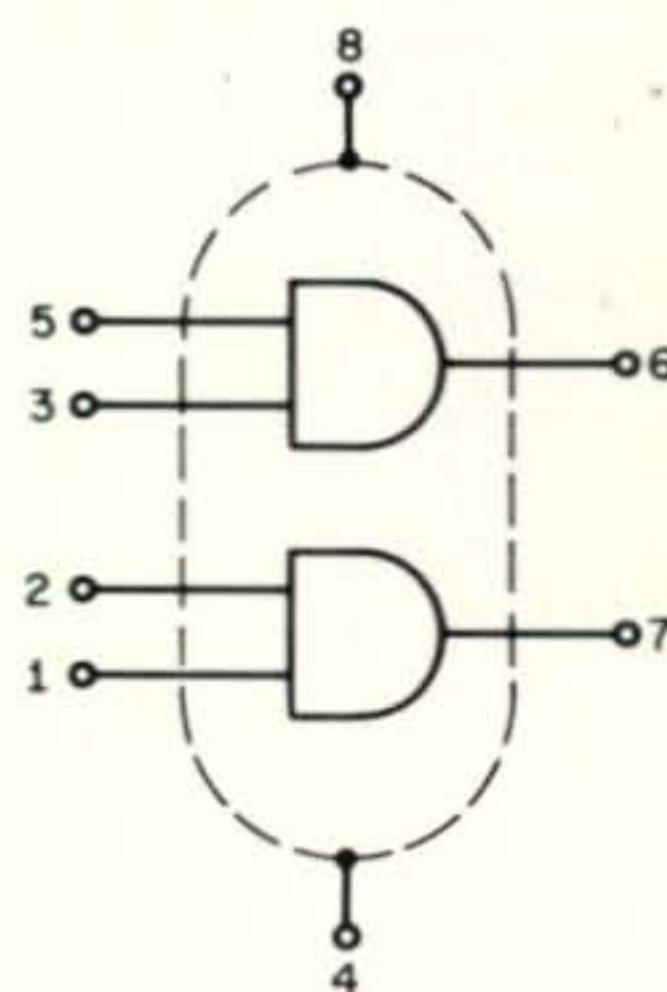
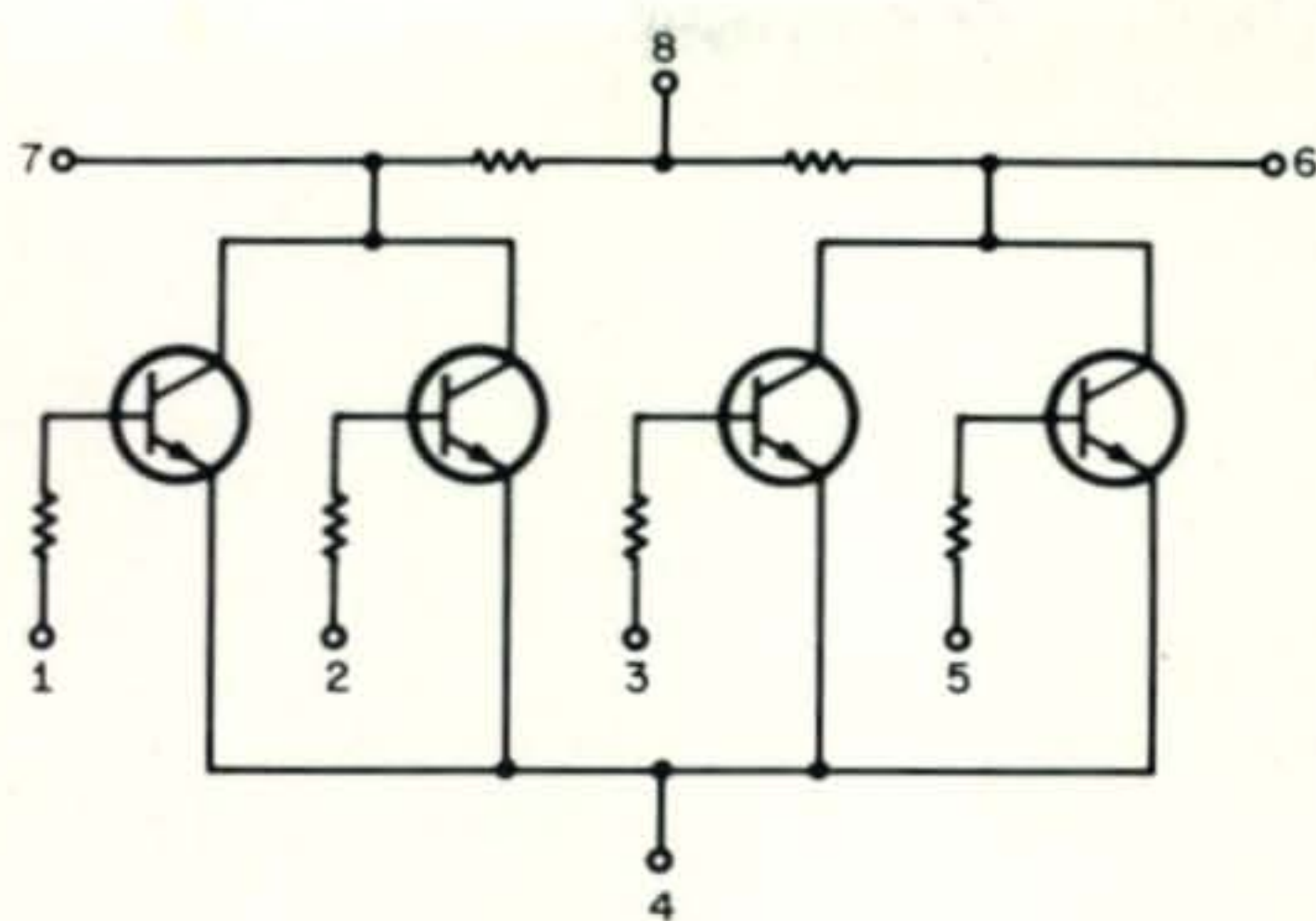


Fig. 1—A dual two input gate digital IC and its short hand notation.

IC Operation

At this point, let's take a look at the individual integrated circuits used and their operation. The first is the dual two input gate. This is shown in schematic form and a shorthand representation in fig. 1.

For the purposes of description, all terminals with a positive voltage will be referred to as being in state "1" and all terminals at ground will be referred to as being in state "0". Terminals 1, 2, 3, and 5 are the inputs to the bases and terminals 6 and 7 are the outputs from the collectors. As a gate, a positive input ("1") to either 1, or 2, or 1 and 2 will cause the respective output, pin 7 to ground ("0"). Also, a "1" on pin 1 will force pin 7 to "0" and alternating "0" and "1" information on pin 2 will not appear on pin 7. In this example, pin 1 is used as an inhibit to prevent information on pin 2 from passing through to pin 7. The information will only pass if pin 1 is returned to "0" state. This feature is used to sort out the dits and dahs and to provide independent dit and dah reset signals for the memories. The entire adder can be interconnected to form a flip flop as shown in fig. 2.

An application of a "1" to either pin 1 or pin 5 will cause the outputs to reverse depending on the state they were in. Also, negative pulses to pins 6 and 7 will cause the outputs to reverse. If pins 1 and 5 are not used, they should be grounded to prevent stray pickup that could cause false triggering of the flip flop.

The other module used is the J-K flip flop shown in fig. 3. This was chosen because of its toggle property upon applica-

tion of a negative going pulse to the clock input, and a pre-set terminal which inhibits the toggle and presets terminal 5 to "1."

There are two other terminals, pins 1 and 3, called *set* and *clear*. If a "1" is applied to the set, its respective output will change state with the next clock pulse if its previous state was "0." At this point, each succeeding clock pulse has no effect on the state of the outputs. The same is true for the clear terminal. This feature was not used and both terminals should be grounded to prevent false triggering of the flip flop. The explanation is included only to complete the description of the operation.

Keyer Design

The keyer design began with the memories. A dual gate was connected as shown in fig. 4. The RC networks between pins 2 and 6, and between pins 3 and 7 serve to isolate the inputs for set and reset purposes. The memories must be able to be reset

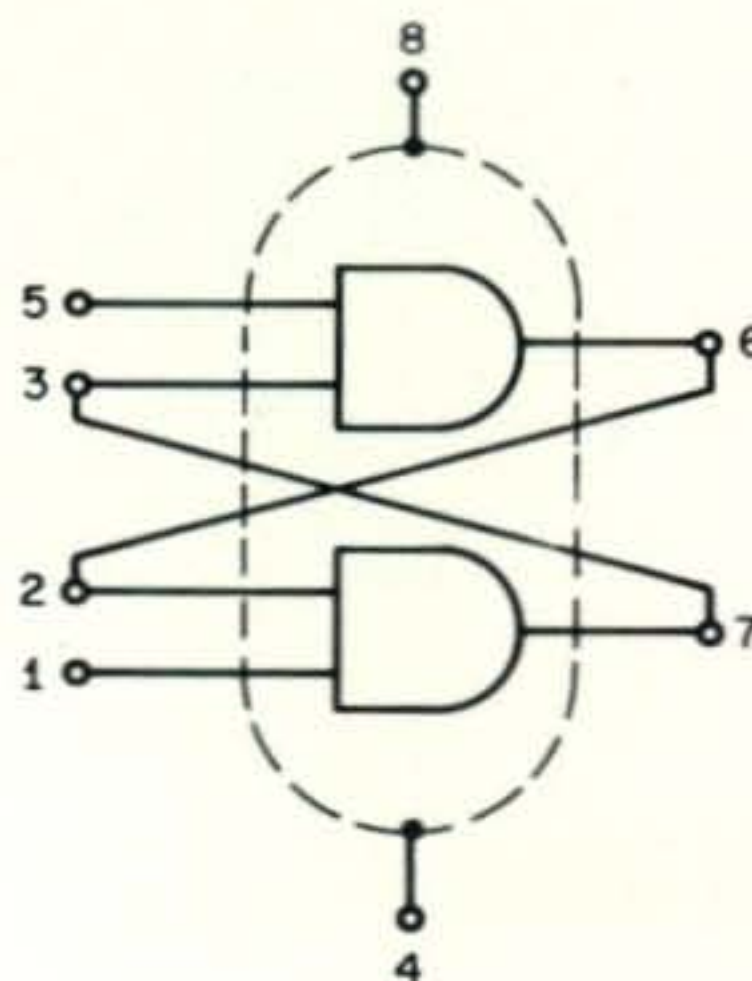


Fig. 2.—A dual two input gate digital IC connected as a flip flop.

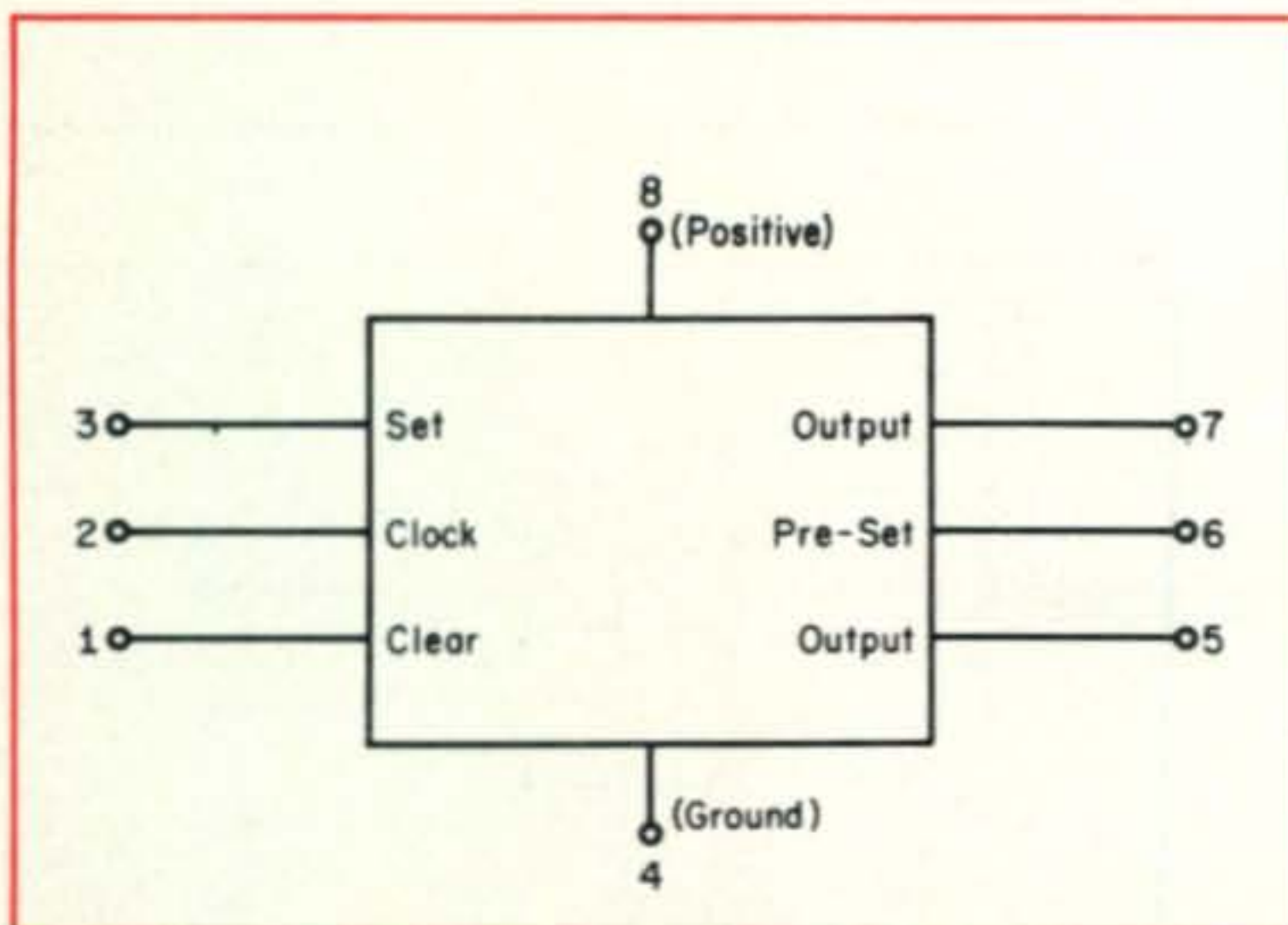


Fig. 3—Block diagram presentation of a J-K flip flop.

momentarily, even if the set terminal is held on, to enable the output to alternate dits and dahs. With the simple connection shown in fig. 2, this would be impossible since a set on one of the terminals would clamp its output to "0" and not allow it to the "1" state until the set was removed.

In the final circuit, shown in fig. 5, two such memories are used, one for the dit and one for the dah (IC_5 and IC_6). The set is now accomplished by closing the paddle contacts to ground or "0" state. This turns the "on" transistor "off" and the output states reverse. The negative going pulse formed by the completion of the character resets the memory.

A logic section is needed to choose the memory first initiated, close the gate, and pick up a signal from the opposite memory, if initiated, at the completion of the original character. (IC_4) The logic section is a dual gate connected as a flip flop. Since a set, reset from negative pulses is not required, the RC connection is not used.

The output states of the logic section can

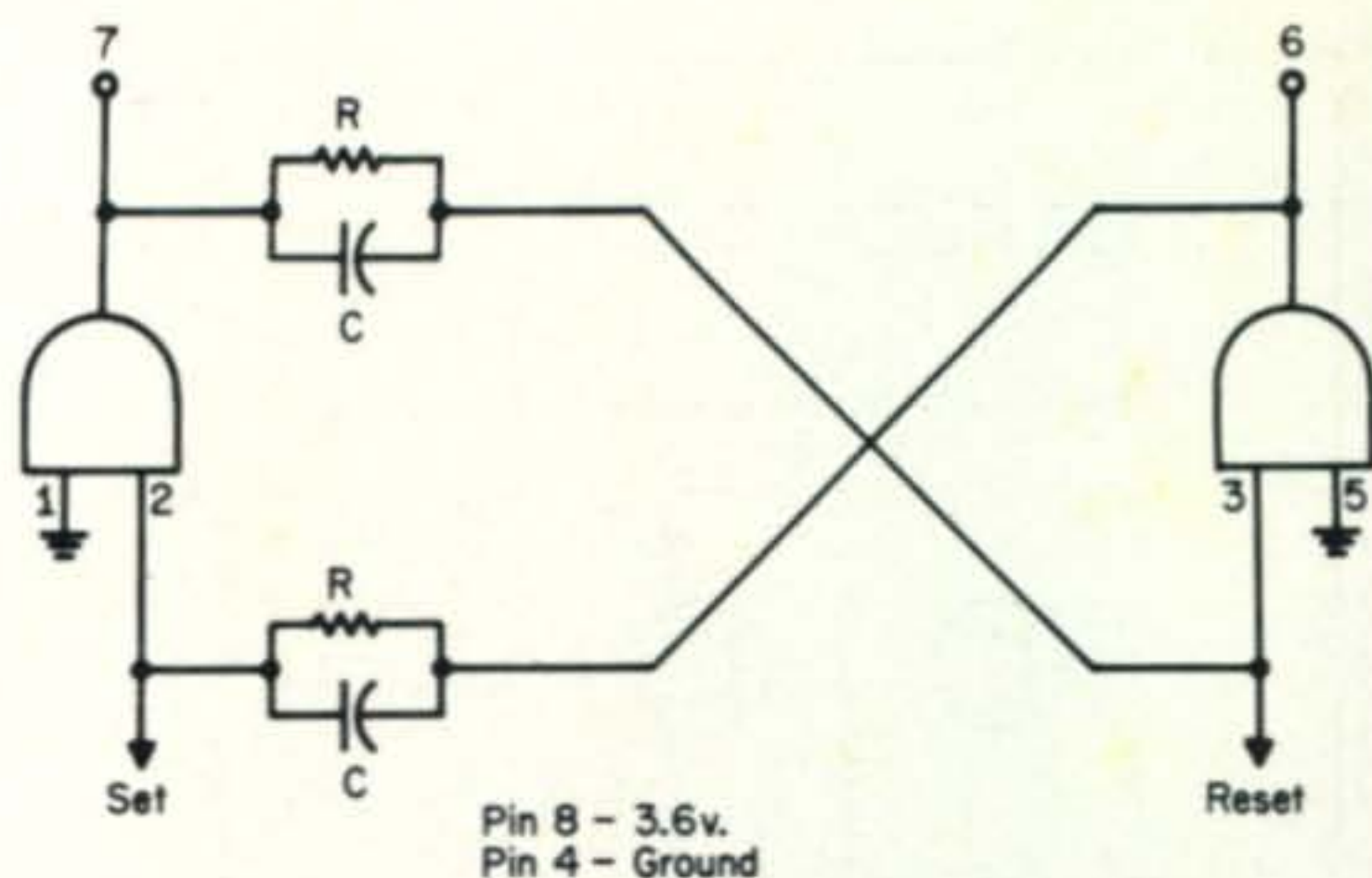


Fig. 4—A dual gate flip flop memory with RC isolating networks for set and reset purposes.

be summarized in fig. 6 remembering that a "0" is ground and a "1" is a positive voltage. If the inputs are actuated in the sequence shown, reading from top to bottom, the outputs take the states indicated by "1" and "0". Notice that the outputs can both be in a "0" state but cannot simultaneously be in a "1" state. This means that both gates can be turned on, by pins 1 and 5, but for them to be off all four inputs must be "0." Since two inputs are connected to alternate outputs, if one output is in state "1" (gate turned off) it is impossible for all inputs to be "0." If pins 1 and 5 are at "0," indicating both memories set, the one set first will actuate the keyer. Upon resetting that memory, the logic responds to the other memory. If one memory is held closed by the paddle contacts, it can still be reset long enough for the opposite memory to actuate the logic circuit.

Time Base MV

The time base used is a standard multi-vibrator except for the supply voltage. ($Q_1 Q_2$) Since the supply is low, the base resistors must be small and the cross coupling capacitors large to provide reliable operation.

The diodes in the ground side of the SPEED control provide a reference voltage for the lowest speed. Without this reference the mv is not reliable at low speeds.

The WEIGHT control is used to set the symmetry of the mv keying.

The diodes, CR_1 and CR_2 , should be silicon units, 1N4001 or equivalent, and diodes CR_3 and CR_4 should be germanium types; 1N34A's are suitable for CR_3 and CR_4 .

The speed is adjustable between 10 to 30 w.p.m. but greater variation can be ac-



Rear view of the keyer showing output connections.

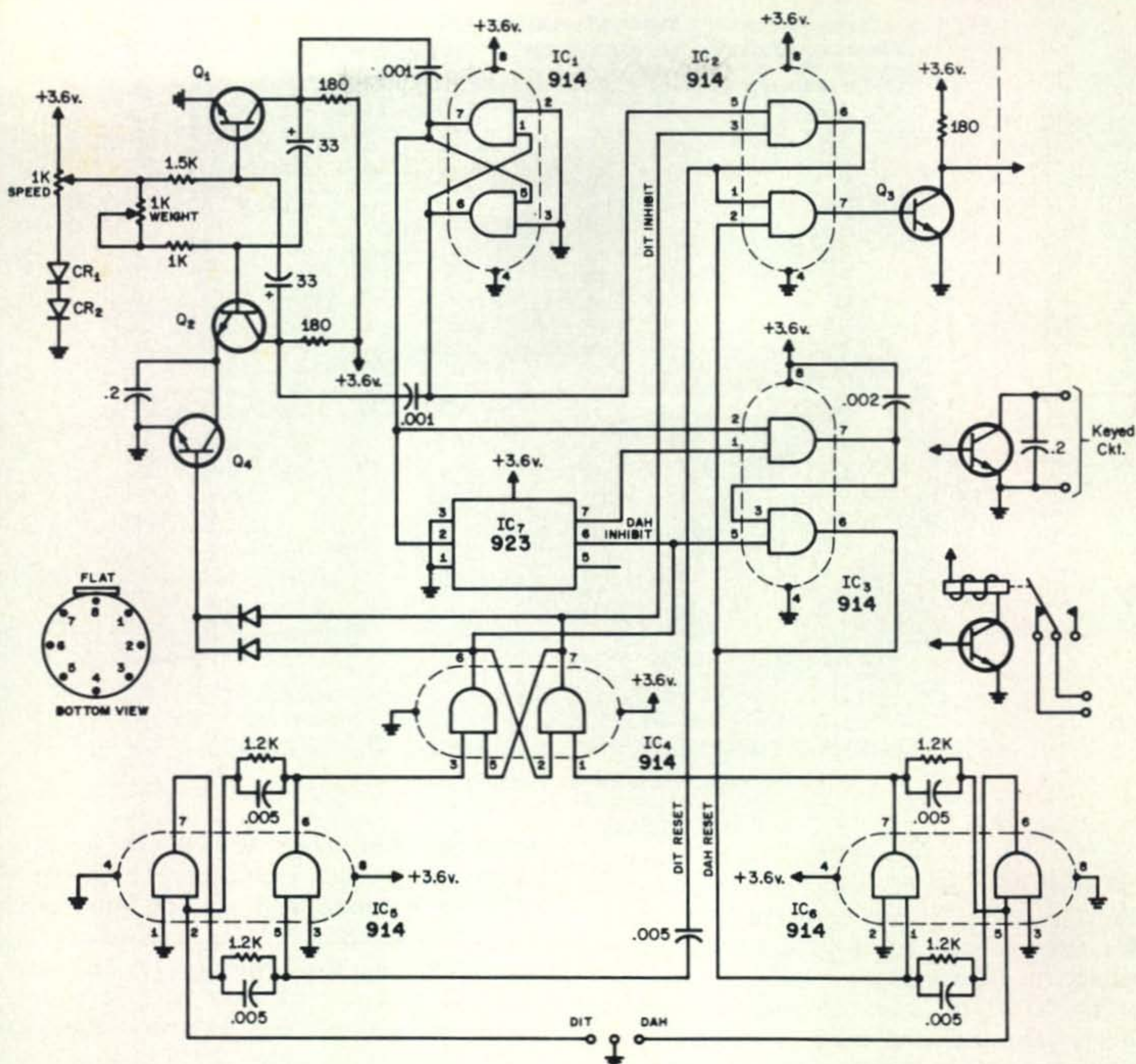


Fig. 5—Circuit of the complete keyer. All resistors are $\frac{1}{4}$ watt and all capacitors are in mf. The basing for both the ua914 and ua923, ICs are shown above.

CR₁, CR₂—Silicon diodes, 1N4001 or equiv.

CR₃, CR₄—Germanium diodes. 1N34A or equiv.

IC₁ through IC₆—Integrated circuit, Fairchild ua 914.

IC₇—Integrated circuit, Fairchild ua 923.

Q₁, Q₂, Q₃, Q₄—Silicon n.p.n. type transistors with low saturation voltage characteristics.

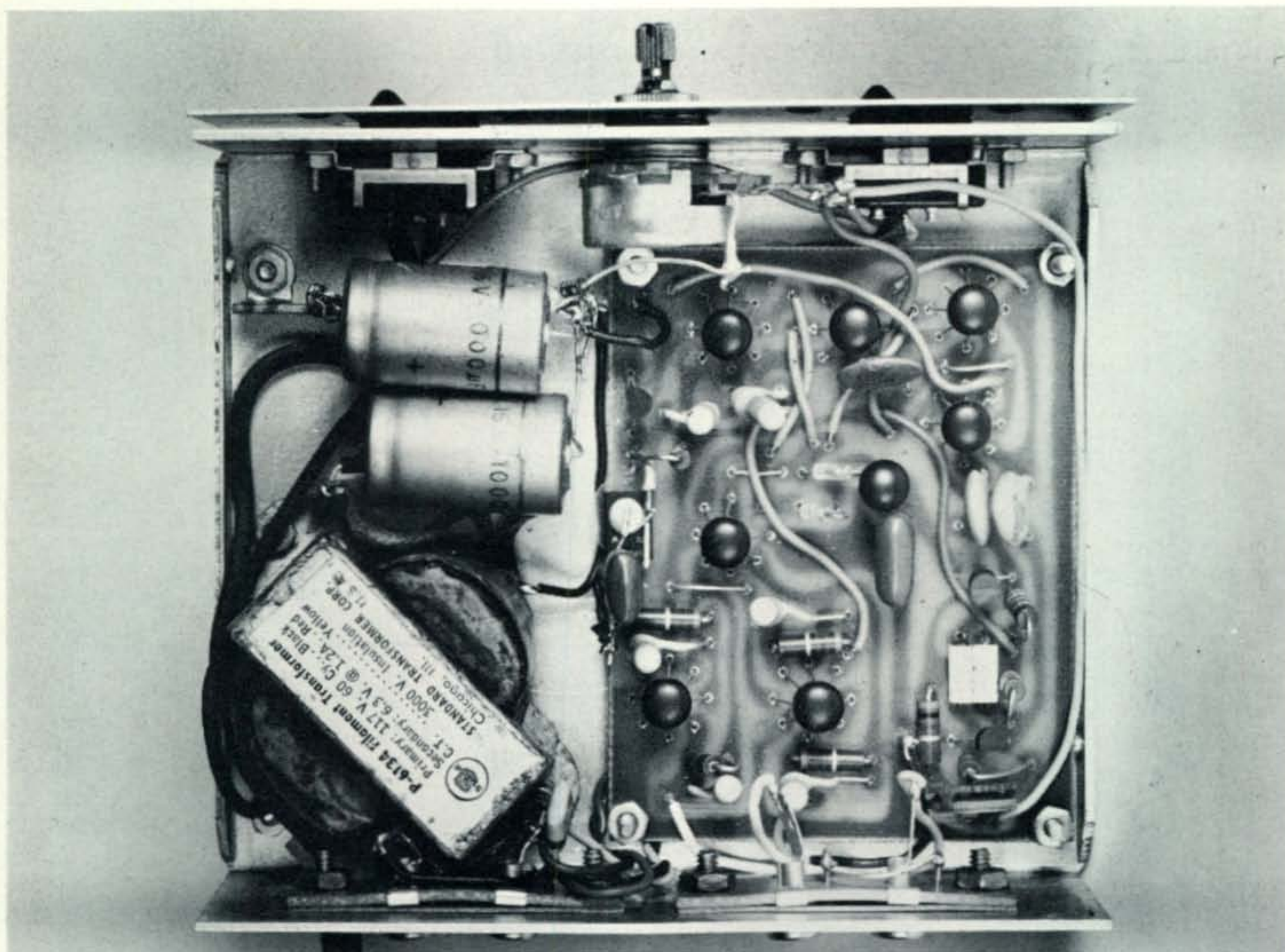
Types 2N2926, 2N3569, MPS6520 or equiv.

complished by switching in auxiliary resistors or capacitors in the time base mv.

The opposite outputs of the mv are used to operate a half adder connected as a flip flop (IC₁). This flip flop generates the dits and produces the steep negative waveform needed to toggle a JK flip flop. Both flip flops are added in one section of the dual gate to form a dah. This method of forming a dah is quite popular and is found in many keyers. The dits and dahs are then fed to another dual gate where they are combined

to form the output (IC₂). The unused input of each gate is used as an inhibit to allow only a dit or dah to reach the output, but not both at once. The output is used to drive a transistor switch or relay for keying the transmitter.

The inhibits are connected to their respective logic outputs. A "1" will not allow information through its respective gate. The inhibit on the JK flip flop is also connected to the dah inhibit since it would change state once when a dit is sent and not return as needed for dah generation.



Interior view of the keyer showing parts layout.

General

The keyer operates satisfactorily between 2.5 volts and 4.0 volts with the I.C.'s used. A higher voltage on these units can cause permanent damage.

The 0.002 mf capacitor across the dah adder, IC_3 , prevents false resetting of the dah memory. The 0.2 mf across Q_4 keeps the keyer running between successive characters.

The keyer works quite well with a power supply shown in fig. 7 but care must be taken to make sure it is well filtered or it will cause erratic operation of the time base.

At three volts the current drain is about 100 ma. The unit worked well with a pair of batteries that were down to 2.8 volts and had high internal impedances.

The IC units used are Fairchild ua914

and ua923 and those needed can be purchased for \$6.30. The other components are quite standard and can be purchased new for about \$6.00. This is a low price considering what the keyer does. A relatively simple keyer could be built using a couple of 914s and a single 923. This would almost be the ultimate in simplicity and low cost.

Construction and Operation

The keyer was built on a printed circuit board 3 × 4 inches with plenty of room to spare.

Using the keyer proved to be as easy as expected. The dit timing is very easy to control, and the squeeze relieves much of the drudgery in sending. The keyer showed no signs of being affected by r.f. from the transmitter.

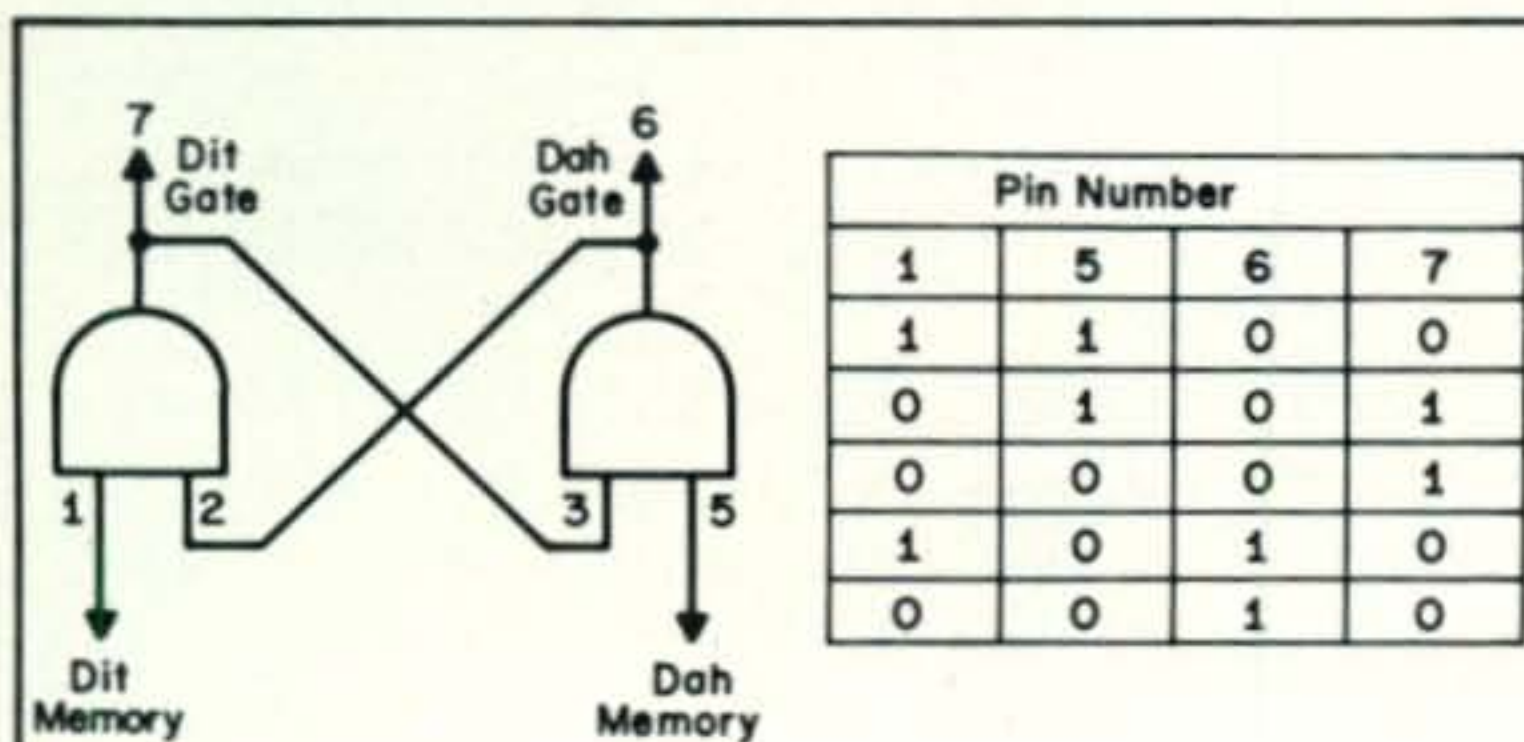


Fig. 6—Summary of the logic section output.

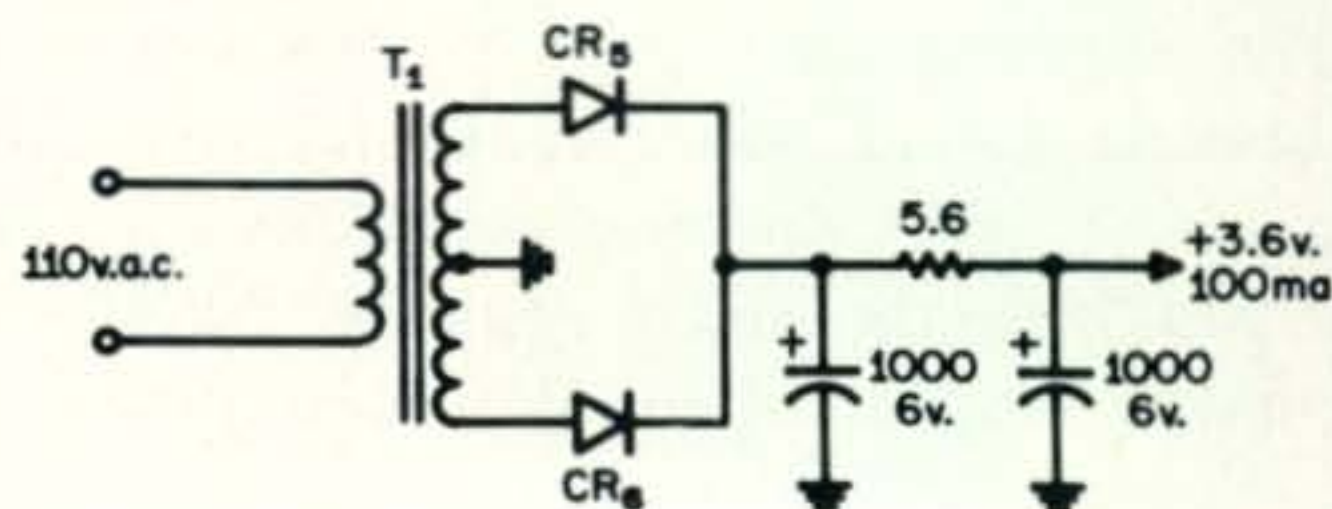


Fig. 7—Circuit of a power supply suitable for operating the keyer. The transformer is a filament type, 117/6.3 v.a.c. at least 0.25 amperes. The diodes are 1N4001 or equivalent types.



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The Heathkit HW-16 Novice

C.W. Transceiver



CQ

Reviews:

The Heathkit HW-16 Novice C.W. Transceiver

BY WILFRED M. SCHERER,* W2AEF

MUCH of the amateur gear placed on the market in recent years has been designed with the phone operator in mind, particularly for use with single-side-band. Cost is relatively high and provisions are sometimes not included for c.w. operation, and where they are furnished, it is often done simply as an "afterthought".

As a different approach, the Heath Company has come up with a low-cost c.w.-only job, the HW-16 Novice C.W. Transceiver. Although directed at the 80-40-15 meter Novice, it also provides high performance

with the basic essentials for the General, Advanced and Extra Class licensees as well and consequently will not be outmoded for c.w. use when the Novice upgrades his license status. It also makes a convenient and all-inclusive package for fixed, portable or field-day operations.

The transmitter section is adjustable for power inputs of 50-90 watts and is crystal-controlled. A v.f.o. input also is provided for later use. Grid-block keying is used on the transmitter, while the receiver is muted with bias and its input is cut off with a solid-state TR switch. There are no relays and

* Technical Director, CQ.

full break-in is possible, even at high speeds. Built-in sidetone permits keying to be monitored, an especially helpful feature for both the Novice and high-speed artist.

The output is fixed for 50-ohm loads and only one tuning adjustment is required for the entire transmitter when the frequency or bands are changed. There also are r.f. and a.f. gain controls, a power level control and two crystal sockets, one each for standard-size holders (pin spacing of .486") with pin diameters of .050" and .093". 80 or 40 meter crystals or v.f.o. may be used.

The receiver is a dual-conversion job for high image rejection and frequency stability. The latter is ensured with a crystal-controlled h.f. front-end, augmented by the use of a low-frequency v.f.o. at the second conversion. The frequency ranges cover the lower 250 kc portion of the 80, 40 and 15 meter bands. Sharp selectivity, especially tailored for c.w., is provided with a 500 c.p.s. crystal-lattice filter, while a clean-tone c.w. beat is obtained from a product detector excited by a crystal-controlled b.f.o.

Other Features

A large easy-to-read circular dial has one scale calibrated quite linearly from 0-250 kc in 5 kc steps spaced about $\frac{1}{8}$ " apart. It is operated by a pinch-drive mechanism that furnishes vernier tuning with about 20 kc of coverage realized with one revolution of the tuning knob.

The rear of the set is equipped with phono-type jacks for the antenna and a loudspeaker, while standard-type phone jacks are provided for the key and headphones. An auxiliary socket supplies power and block-grid keying facilities for an external v.f.o.

A built-in power supply is an all solid-state affair and is protected from overload by a self-resetting circuit breaker.

The dimensions for the set are $6\frac{1}{2}$ " $\times$ $13\frac{3}{4}$ " $\times$ $11\frac{1}{2}$ " (H.W.D.) and it weighs 20 pounds.

Circuit Details

A block diagram for the HW-16 is shown at fig. 1. The transmitter section starts off

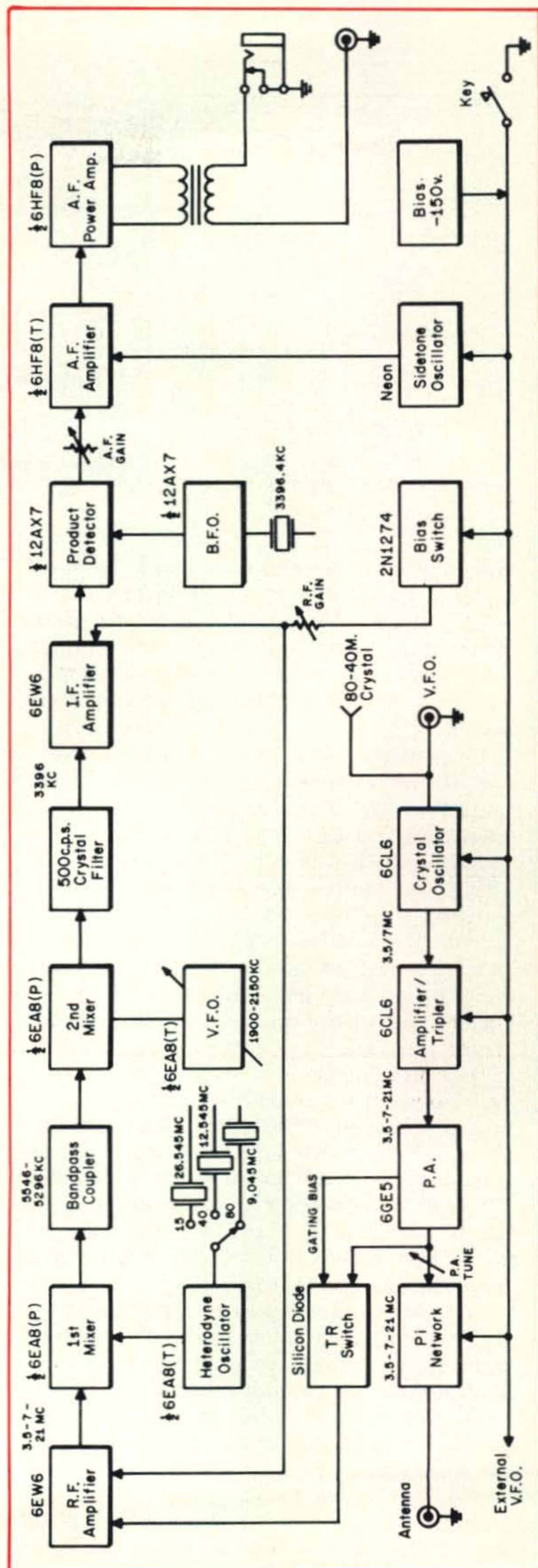
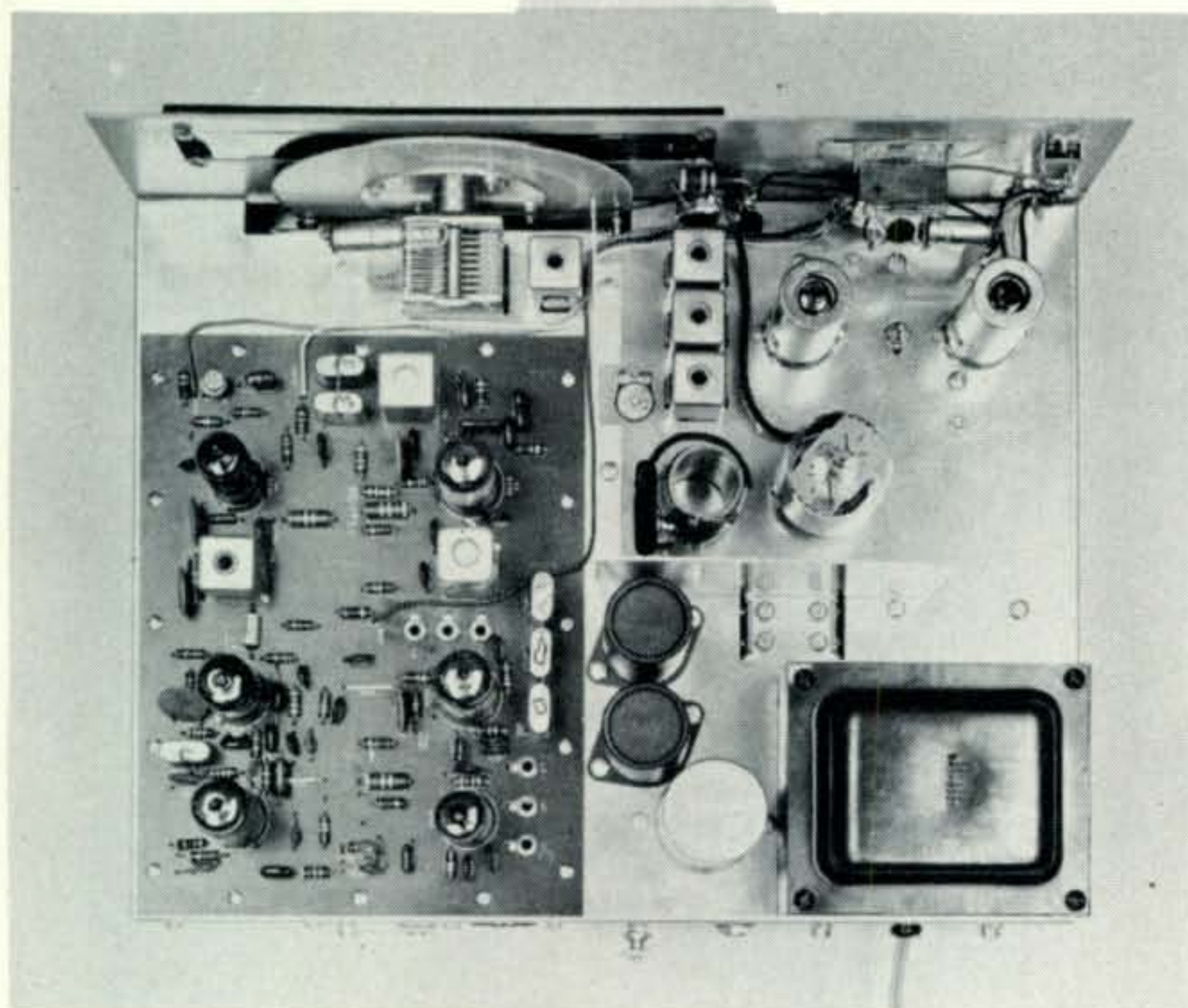


Fig. 1—Block diagram for the HW-16. Details are given in the text.



Top view of the HW-16. The circuit board for the receiver is at the left with its v.f.o. tuning capacitor and dial near the panel. The transmitter section is at the upper right, the power supply is at the lower right.

with a 6CL6 crystal oscillator with 80 or 40 meter crystals in a modified Pierce circuit used between the control and screen grids. A separate input jack to the grid permits v.f.o. operation for upgraded licensees. The plate circuit is fix-tuned to 40 meters and thus allows the tube to function as a doubler with 80-meter crystals (or v.f.o.) for 40 or 15 meter operation, or as an amplifier with 40-meter crystals. Low-C is used here and with 80-meter operation, the circuit inductor merely serves as an r.f. choke and the pentode plate operates as an untuned amplifier.

The 6CL6 driver stage is bandswitched with fix-tuned circuits at the plate. It functions as an amplifier for either 80 or 40 meter-band operation, as a tripler for 15-meter use.

The final stage is a 6GE5 Compactron beam-power tube which operates as a straight-through Class-C amplifier on all bands. A pi-network output circuit is designed with fixed loading for essentially 50-ohm impedances (or s.w.r. up to 2:1) and is obtained by fixed capacitors engaged with the bandswitch. Capacitance-bridge neutralization is employed.

R.f. output is sampled and rectified by a diode to provide d.c. to operate the relative-output meter which also can be switched to indicate the p.a. cathode current.

A control is included to adjust the p.a. screen voltage, so that the power level may be set within the legal bounds of 75-watts input for Novice-Class operation. This is indicated by a red calibration marker on the meter. For higher-class operation, the input

may be raised to 90 watts. The block-grid keying is used on all stages of the transmitter, including an external v.f.o. that might be in use.

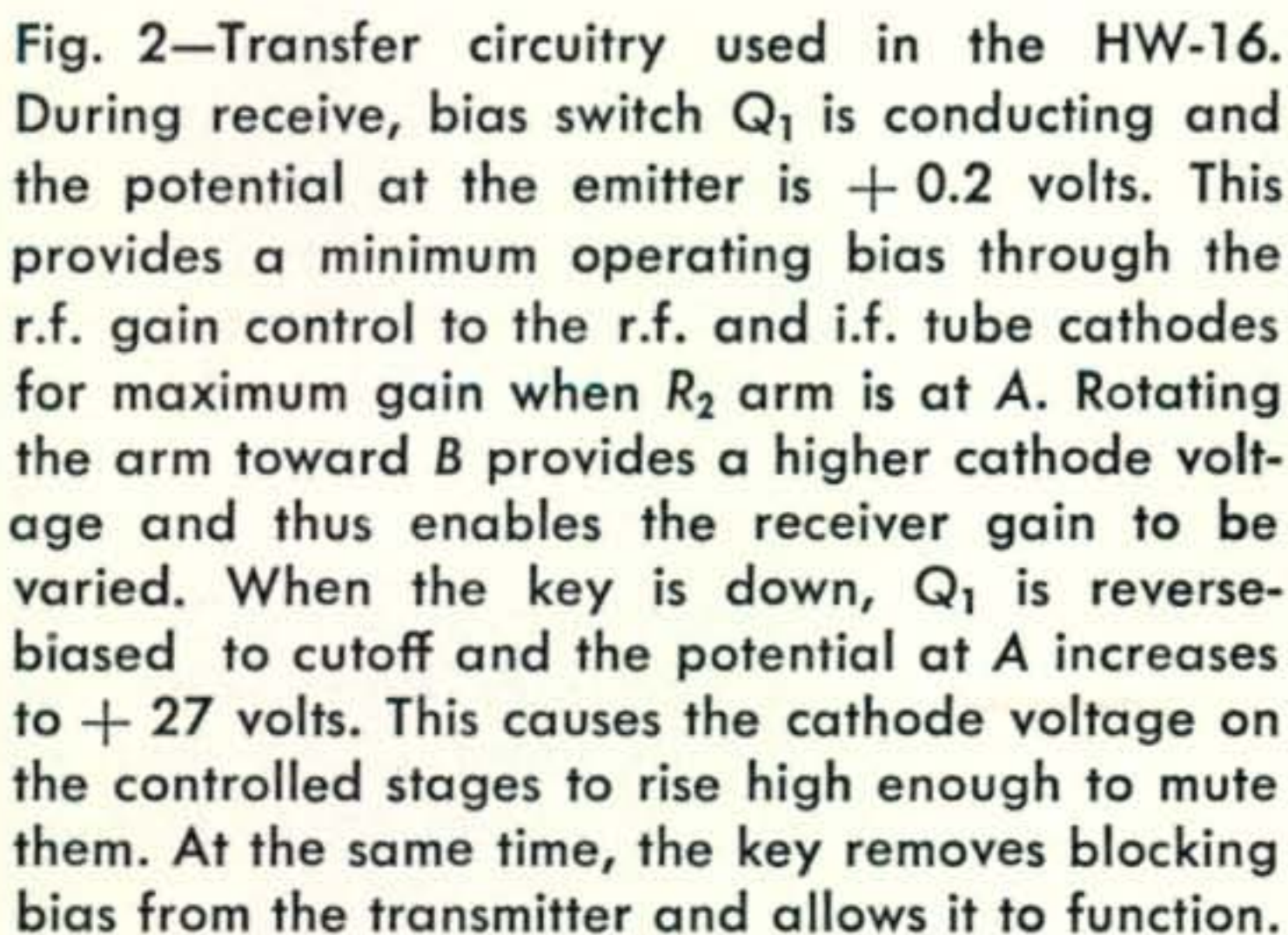
Receiver Section

The dual-conversion receiver uses a first i.f. of 5546-5296 kc and a second i.f. of 3396.4 kc. It has a 6EW6 r.f. stage, the input of which is tuned by the p.a. Pi-network. The plate is fix-tuned with bandswitched broadband circuits for the related range. The first-conversion stage is a 6EA8 the pentode section of which is the mixer. The triode portion is the heterodyning oscillator which is crystal-controlled using a plate-tuned configuration. Injection to the mixer is through stray-capacitance coupling within the tube.

The mixer output is coupled through a bandpass circuit to the second-conversion stage consisting of another 6EA8 pentode mixer with the triode used for a tunable injection oscillator. This v.f.o. functions in a Colpitts circuit on a single range of 1900-2150 kc with injection to the mixer taken from a tap on the feedback capacitance divider. The resulting i.f. at the mixer output is 3396 kc.

This signal is fed to an i.f. amplifier stage through a two-pole crystal filter using 3395.15 and 3395.45 kc crystals to provide a 6-db bandwidth of 500 c.p.s.

An audible beat is obtained from a conventional-type product detector with a b.f.o. signal derived from a crystal-controlled triode, oscillator. The frequency is 3396.4 kc,



so that a beat of about 1000 c.p.s. is obtained when the signal is peaked in the filter passband.

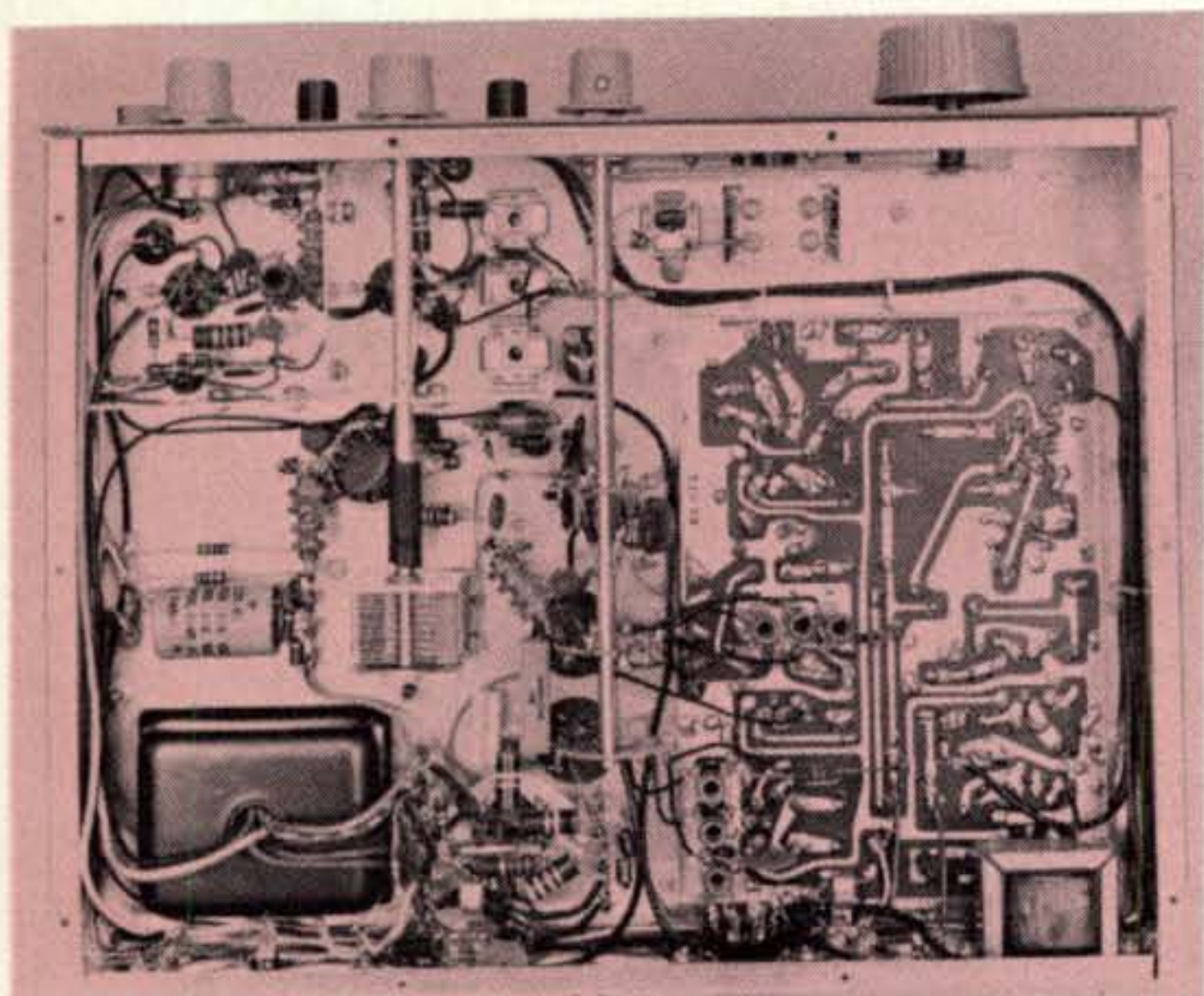
The output from the a.f. power amplifier can be fed either to an external loudspeaker or to headphones. A closed-circuit phone jack is in series with the speaker jack and when the headphones are plugged in, the speaker remains in the circuit, but due to the high impedance of the phones, the speaker level drops to an insignificant amount without affecting headphone operation.

The r.f. gain control affects the r.f. and i.f. stages. There is no a.g.c.

Referring to fig. 2, when the key is de-

pressed, it removes the blocking bias from the transmitter stages and mutes the receiver through a "bias-switching" transistor. A diode TR switch, activated by d.c. from the p.a. cathode, disables the receiver antenna input. Unlike most conventional TR switches, this one does not generate r.f. harmonics. It is one often used in advanced CB gear, but it is the first such arrangement we've seen in ham equipment. Also shown at fig. 2 is the sidetone-oscillator circuitry which is a relaxation type using a neon bulb.

December, 1967 • CQ • 21



Bottom-chassis view of the HW-16. It is a neat and uncluttered affair with plenty of "elbow room." The p.a. tuning capacitor is at left of center.

volts bias. A 3-ampere circuit breaker is contained in a small glass envelope below the chassis and is installed in the 120 v.a.c. circuit to provide overload protection. Should the circuit-breaker trip, it will reset itself after several seconds.

Assembly

From our past experiences with kits, the HW-16 is one of the easiest to put together, so the work should pose no problems for the newcomer.

The receiver section is assembled (by the consumer) on a printed-circuit board, thus simplifying much of the work and ensuring proper wiring and lead dress and minimizing the possibility of errors. The transmitter and power supply are built on the chassis with point-to-point wiring. Only three stages are involved for the former and there is plenty of room in which to do the work.

Although the job can be done in about 15 hours by an experienced hand, we recommend that the newcomer take his time, carefully studying each instruction step and making certain it is understood before proceeding with it. Frequent reference to the top and bottom chassis-view photographs at the rear of the manual will be helpful for noting exactly how most of the components should be positioned, particularly in one or two "tight" spots, such as where the resistors are clustered around electrolytic capacitor *S* as outlined in most of the steps in column 1 on page 29 and as illustrated in pictorial diagram 15. It also will pay to look ahead to

see how the bandswitch will eventually be mounted, so that a few components, which are to be previously installed near it, will allow proper clearance.

After the wiring is completed, examine each connection carefully to make sure it is well soldered, especially on the circuit board and at tie-strip terminals where two or more leads are connected. Also check the circuit board for "solder" shorts between foils. A magnifying glass will be helpful for these observations.

On the referred-to photos, the components are identified by the schematic designations, thus making it easier to locate the various parts, should this be necessary with tracking down difficulties or with other service work.¹

Alignment

Initial test and alignment requires the use of a v.t.v.m. (or 20,000 ohms-per-volt v.o.m.), a few 80 and 40 meter crystals and a 50-ohm dummy load. The inductors and transformers have been preset at the factory, so only slight retuning may be needed, thus making the alignment simply and quickly accomplished. The receiver v.f.o. similarly requires only slight retouching which is done in conjunction with a crystal near each end of the 80-meter range.

Performance

The measured performance of the HW-16 was as follows: Transmitter Power Output: 38 and 45 watts with input of 75 and 90 watts respectively, slightly less on 15 meters; Receiver Sensitivity: 1, 0.5 and 0.25 μ v on 80, 40 and 15 meters respectively²; Image Rejection: at least 70 db on 80 and 40, 65 db on 15; I.F. Signal Rejection (5.5 mc): 50, 40 and 60 db on 80, 40 and 15 respectively, (3396 kc) at least 75 db on all bands; Selectivity: 490 c.p.s. @ 6 db, 2.3 kc @ 60 db; Stability: 250 c.p.s. drift after 15 minutes from cold start at 68° F. ambient, 350 c.p.s. next 30 minutes, 100 c.p.s. or less per hour thereafter. With $\pm 10\%$ line-voltage changes the frequency shift was ± 40 c.p.s. at instant of change, otherwise ± 10 c.p.s. No frequency shifting or microphonics occurred under conditions of vibration.

Although no obvious TVI precautionary measures are included in the unit, such as

¹ An X-ray view of the circuit board also is included.

² For 10 db signal-to-noise ratio.

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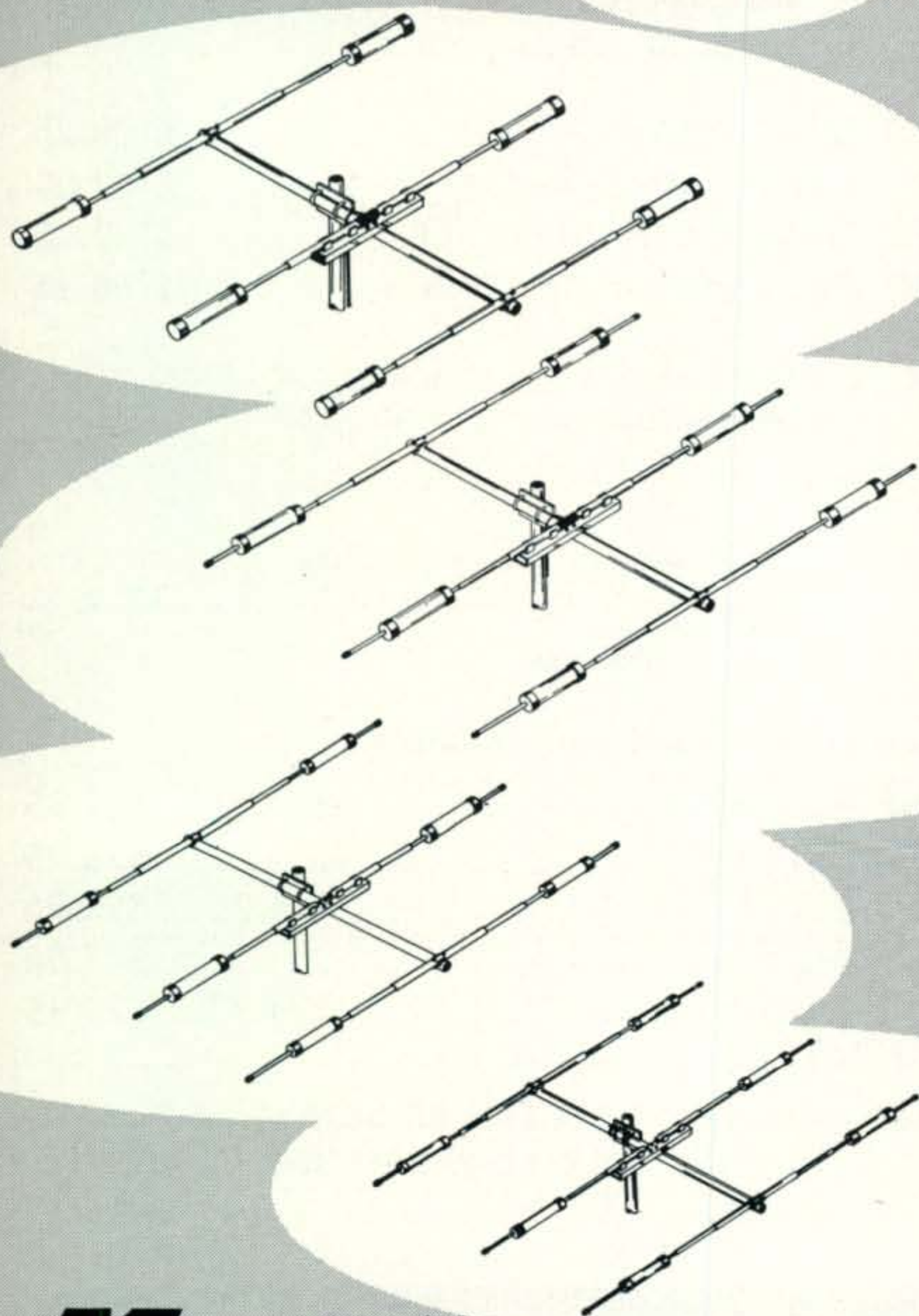
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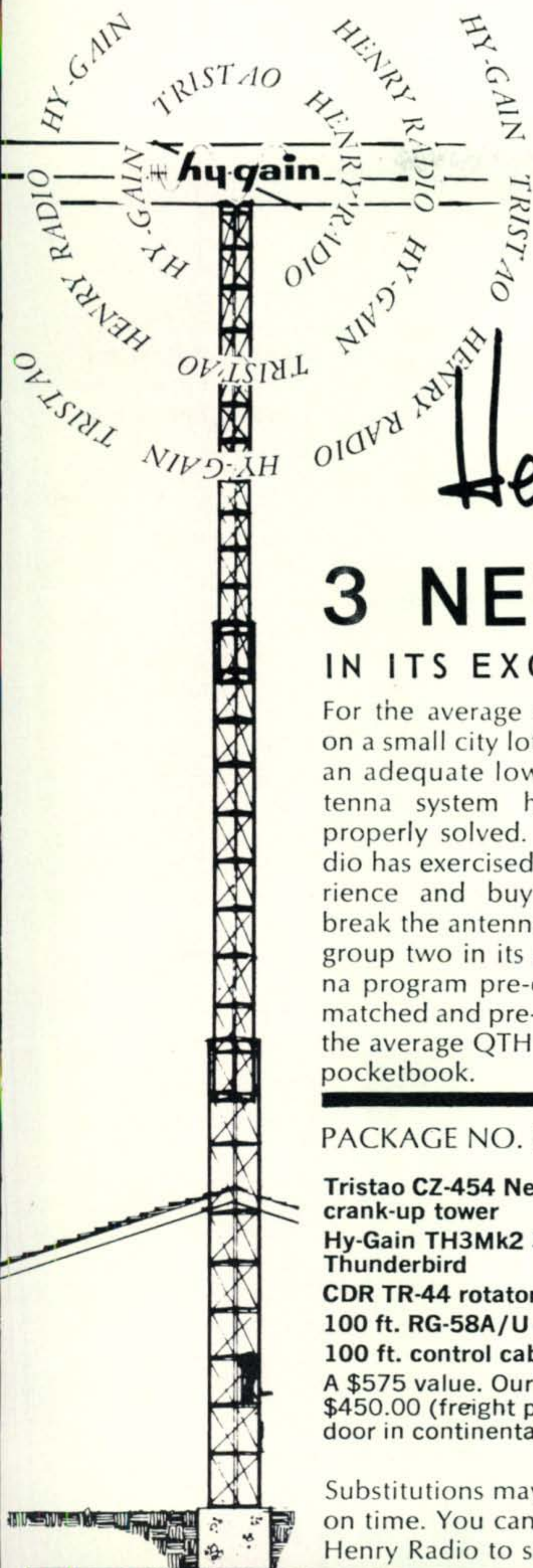
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New Readers Service on Page 120

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complete shielding, filtering of external leads, etc., TVI was not experienced on Channels 2-13 on an antiquated TV set while the HW-16 was operated in the same room with the set.

Operationally the transmitter keyed nicely as found with on-the-air reports and by monitoring with another receiver and an oscilloscope, but with some crystals a bit of chirp was evidenced, particularly at speeds faster than the Novice rate under which conditions it was also found that crystal starting was just slow enough to cause dots to be noticeably shortened by a percentage that increases as the code speed is raised. This effect was not evidenced while using a homemade v.f.o. conjunctively keyed by the blocking bias.

If the receiver is tuned to the transmitting frequency, the signal can be heard in the receiver with *quite a bit* of chirp;³ however, this is not indicative of the character of the transmitted signal, but rather, is due to a shift in the receiver v.f.o. frequency only, since no voltage regulation is provided to compensate for voltage changes caused by the extra load on the power supply when the transmitter is keyed.

The sidetone monitor has a typical neon-oscillator tone quality of about 1000 c.p.s. There is no control to vary the tone level, but if desired, it can be changed by installing a different size fixed resistor in the oscillator circuit.

Break-in operation is excellent, functioning without hesitation at any code speed. You don't have to throw any switches to transmit, you simply press the key. In addition, there is no relay to cause annoying clatter or sluggish operation.

Tuneup is simple. You just plug in the desired crystal, switch to the wanted band and adjust only one control (p.a. tune) for maximum output indicated on the meter. The correct power level for the class of licensee is then set with the power control according to the plate-current reading.

The receiver v.f.o. tunes smoothly, its dial is well illuminated and calibration is quite accurate over the range. Once the transmitter has been adjusted for a band, no other receiver adjustments will be needed; otherwise, only a touch-up of the p.a. tune will be required to peak signals. Since there

is no a.g.c., the level must be set with either the r.f. or a.f. gain controls according to the strength of the incoming signal. Thus, where very strong signals are suddenly encountered, they may be a bit rough on one's ears.

The simplicity, ease of operation, convenience and desirable characteristics of the HW-16 have already provided many pleasant and relaxing hours of operation for this former brass-pounder, enabling him to brush up on c.w. operation and to work some DX on 15 meters, while getting away from the grating yackity-yack of s.s.b. It should similarly be just the ticket for the Novice as well as for the seasoned operator. Its low cost also makes it attractive, as should be the fun of building it.

With the Heathkit HW-16 Novice C.W. Transceiver you get both a receiver and a transmitter for a price not much more than the cost of one and it thus can be a bargain at the kit price of \$99.50. It'll make a fine Christmas gift for the beginner or the boy going off to school. For higher-class operators, a matching v.f.o., the Model HG-10B, is available at \$37.95 (kit). These are products of the Heath Company, Benton Harbor, Michigan 49022.—W2AEF

New Amateur Products



Weems

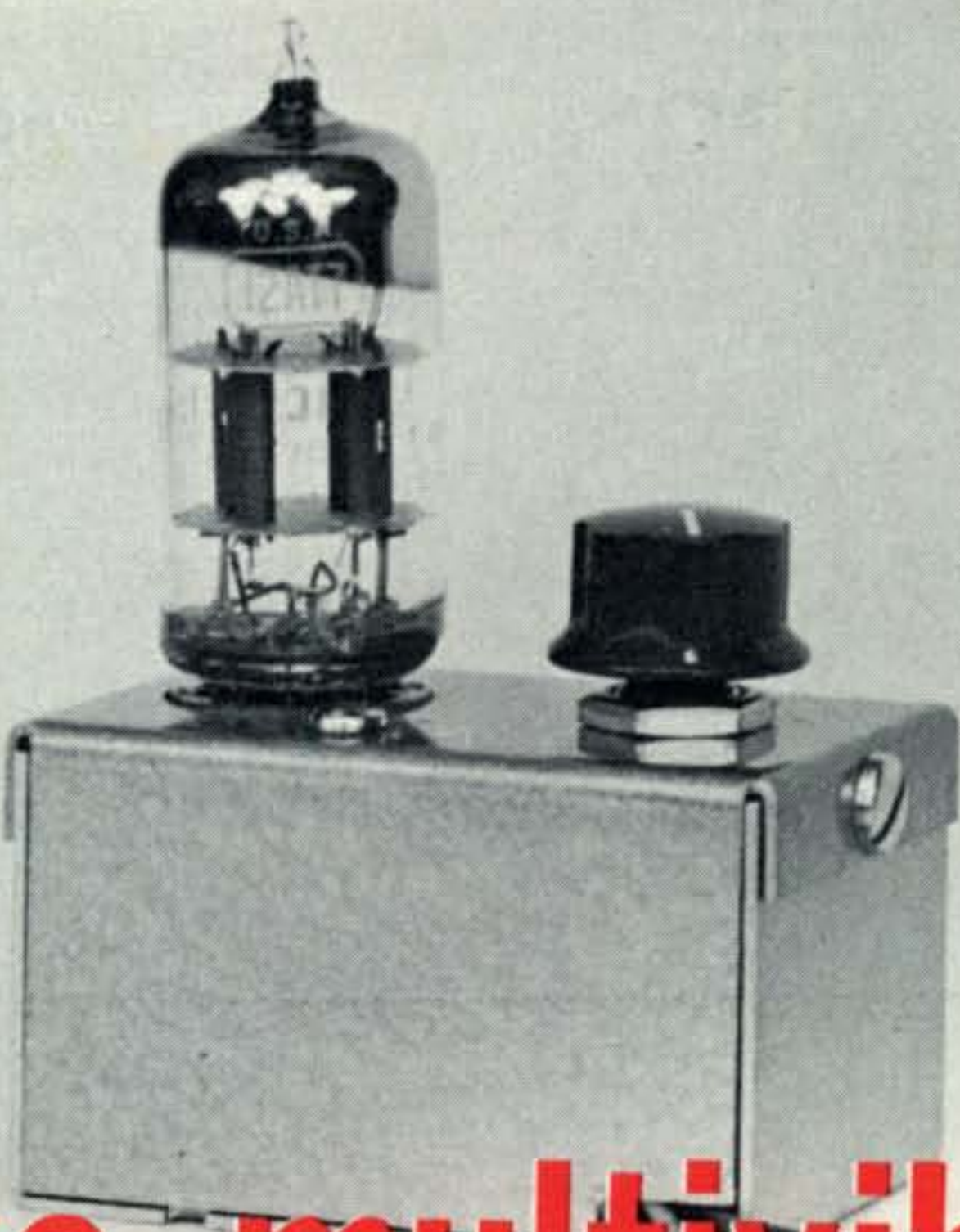
A new device from Weems & Plath provide the user with local standard time at any area. It is made of heavy plastic, with charts for N. and S. hemispheres on reverse side. For full specs write Weems & Plath, 48 Maryland Ave., Annapolis, Md. 21401 or circle 78 on page 126.



Perma-Power

Perma-Power announced their model D-210 automatic voltage regulator for units up to 400 watts. Complete details from Perma-Power, 5740 N. Tripp Ave., Chicago, Ill. 60646 or circle 79 on page 126.

³ Although the receiver is *completely* muted for on-the-air signals, it is not so for your own signal and thus a means is provided for spotting your own frequency, especially when a v.f.o. is in use.



a 25kc multivibrator

BY WILFRED M. SCHERER,* W2AEF

THE low-frequency ends of the restricted amateur-band segments, which will be in force under the incentive-licensing rules, occur at a multiple of 25 kc; consequently, for those operators not in the privileged extra-class group, the 100 kc crystal calibrator usually found installed in receivers cannot provide the means for accurately determining the legal band limits. All is not lost however, since by adding a 25 kc multivibrator, locked to the 100 kc standard, band-edge markers at the 25, 50 and 75 kc points can be obtained in addition to the normal 100 kc ones.

Such an add-on device is the multivibrator described here. It is a very simple affair and one that is physically small enough to allow its installation in almost any receiver. Power requirements are: 6.3 v.a.c. @ 0.3 a. and 150-250 v.d.c. @ 5 ma. Excessive additional drain on the receiver power supply thus should not be experienced.

The multivibrator is a cathode-coupled type with circuitry as shown at fig. 1. It is a free-running affair which can be locked at a frequency determined by R_{5-6} and C_2

when it is synchronized with a stable driving source such as a 100 kc crystal calibrator signal. The output is an unsymmetrical square-wave and thus is rich in harmonics.

Construction

The model shown here is built in a $1\frac{1}{4}'' \times 1\frac{7}{16}'' \times 2\frac{3}{16}''$ box.¹ Drilling dimensions are given at fig. 2. The tie strip is a four-terminal job on which one of the terminals is a ground point. The strip is installed by soldering its mounting foot to the back of the potentiometer as shown in the photo. Except for R_5 and C_2 , component values are not critical and may differ by $\pm 20\%$. To facilitate assembly by the reader, the physical wiring arrangement is illustrated at fig. 3.

The external-connecting leads are brought out through a notch cut in one corner of the portion of the box on which the parts are installed; however, they may be routed in any other manner such as through a hole in the bottom of the lower half of the box to enable them to be passed unseen through

* Technical Director, CQ.

¹ LMB, Model M-00. Available from Midway Radio, 58 West 45th Street, New York, N.Y. 10036.

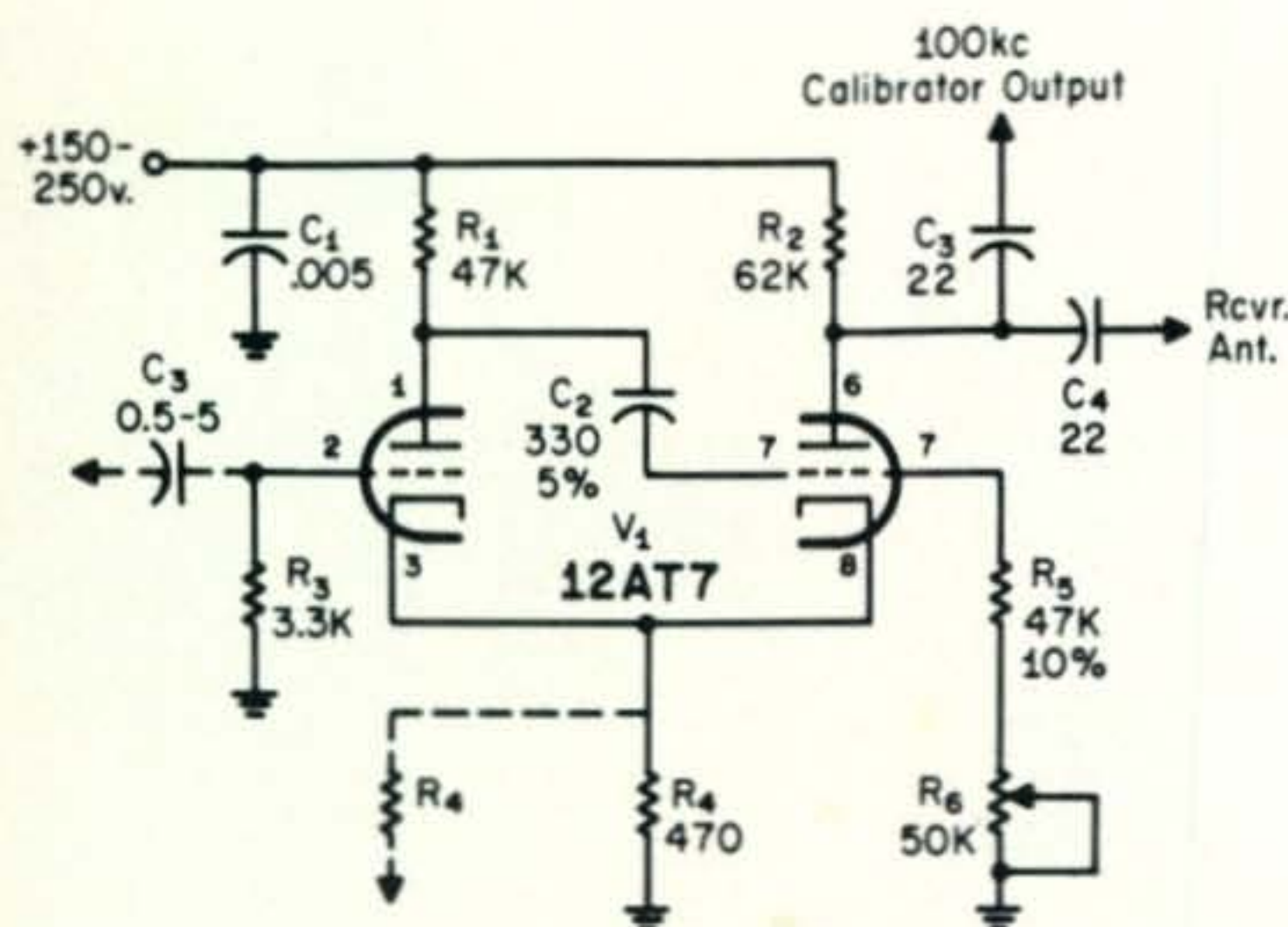


Fig. 1—Circuitry for the 25 kc Multivibrator. Resistors are $\frac{1}{2}$ watt. C_2 is 5% mica. Other capacitors may be mica, disc or tubular ceramic. Alternate connections shown by dashed lines for R_4 should be used if existing calibrator is operated with switch in its cathode return. Alternate connection for C_3 is also indicated at pin 2. See text for both cases.

another hole in the equipment chassis under the point at which the unit is installed.

Installation

The multivibrator should be installed near the existing 100 kc calibrator and may be so done on top of the chassis or on a side brace of the receiver, using self-tapping screws at the bottom or side of the device's box. If a flat mounting surface is not available due to space limitations or interference from existing screw heads, an L-shaped bracket may be used for a support.

The B-plus lead should go to the crystal-calibrator side of its on-off switch; however, if the switch for the calibrator is located in its cathode return, instead of in the B-plus

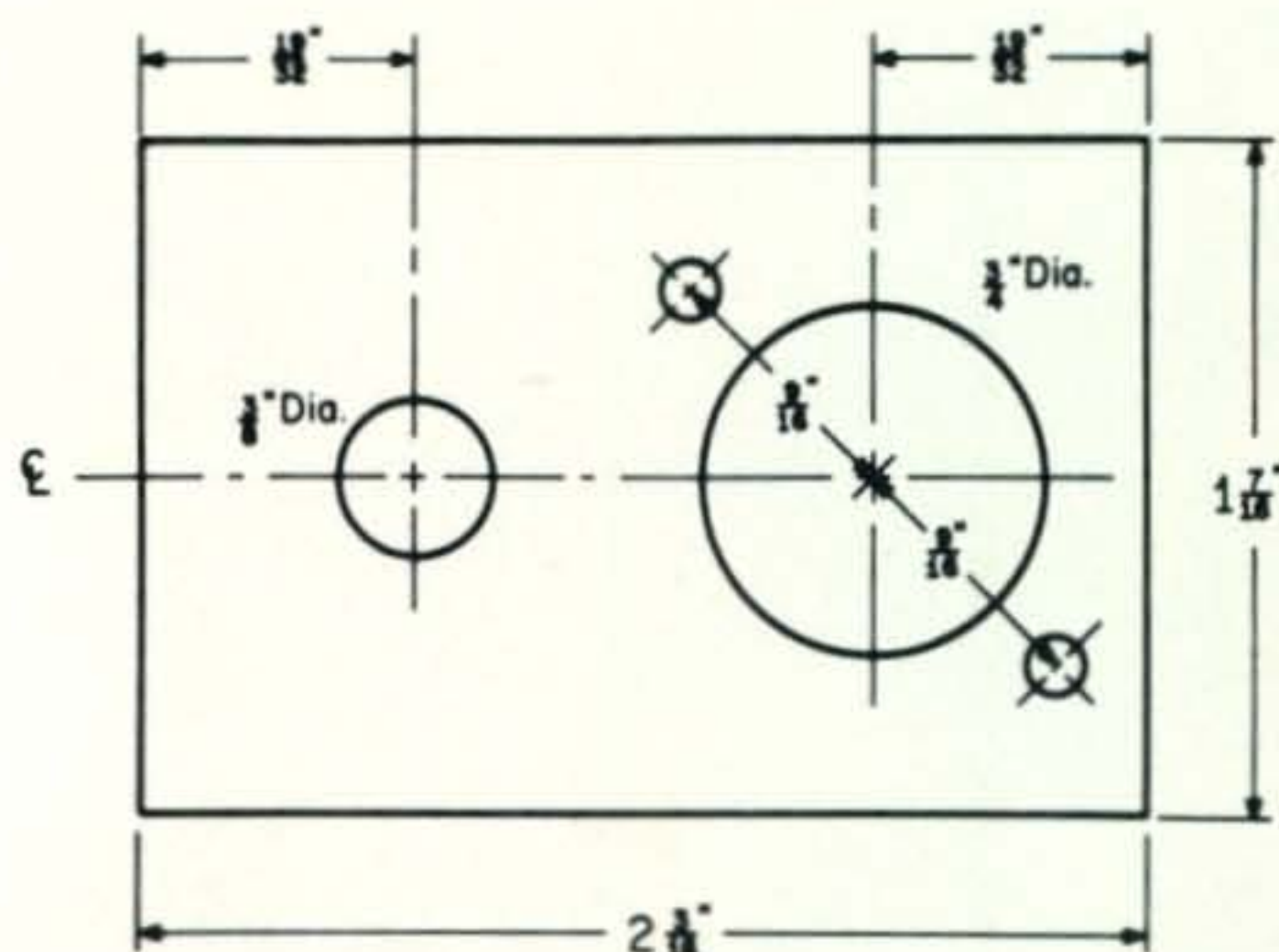


Fig. 2—Drilling dimensions for 25 kc Multivibrator built in LMB type M-00 box.

line, a single-terminal tie strip will have to be added on the inner side of the multivibrator box with the bottom end of R_4 connected to this terminal instead of to ground. A lead should then be connected between this terminal and the cathode of the calibrator. The B-plus for the multivibrator then connects directly to the receiver B-plus.

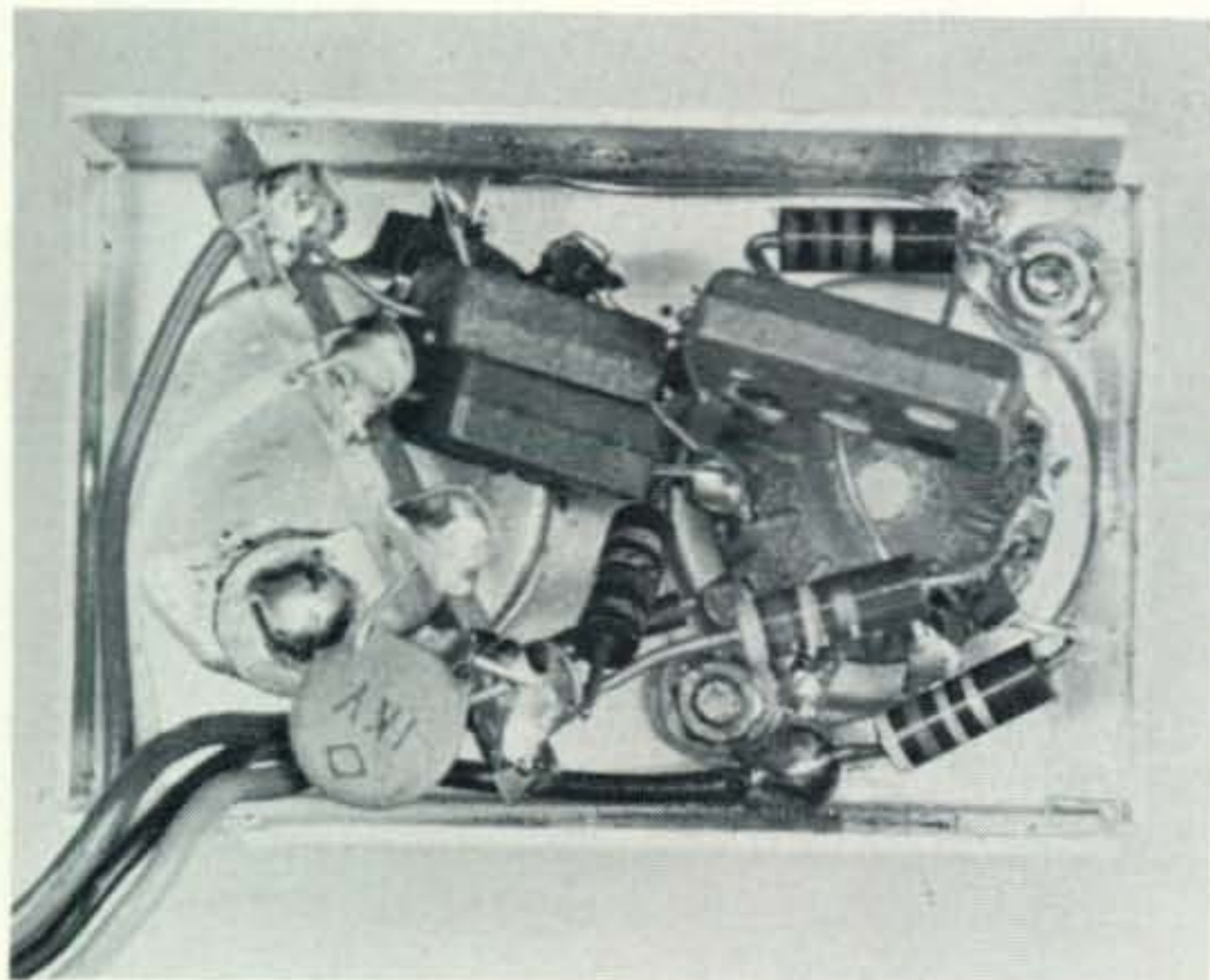
Where the r.f. leads to the multivibrator are exposed above the chassis it would be well to shield them to minimize the possibility of stray-signal pickup into the receiver.

Adjustment

The 25 kc multivibrator is adjusted as follows: Remove the tube from it and with the 100 kc calibrator and the receiver b.f.o. turned on, note the dial reading for two adjacent 100 kc points on the lowest-frequency band. Set the receiver dial at a point calibrated for a 25 kc spot² away from one

² Or where a 25 kc interval might be expected to appear.

[continued on page 114]



Bottom chassis view of the 25 kc multivibrator. See fig. 3 for details.

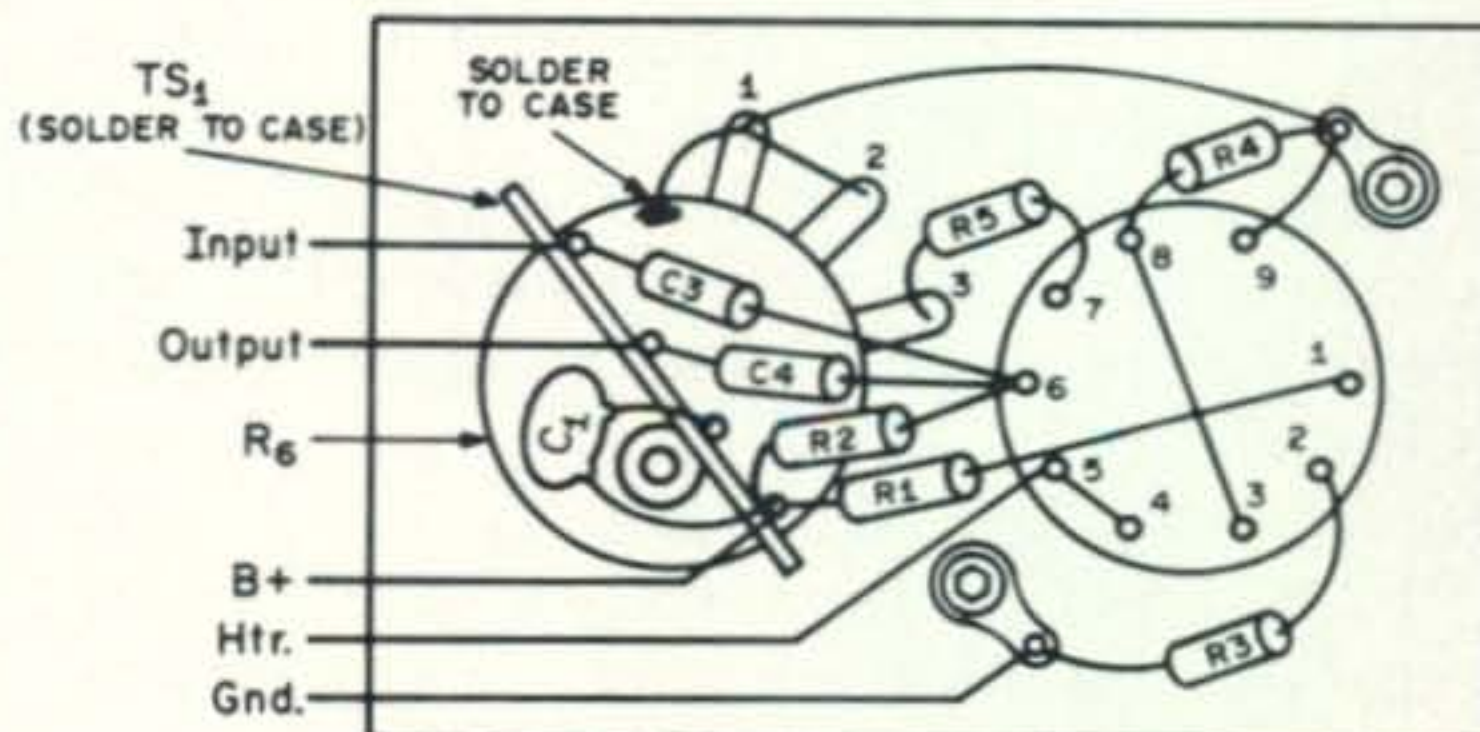


Fig. 3—Wiring layout for the 25 kc Multivibrator. The mounting foot for TS-1 is soldered to the back of R_6 . The ground lead from terminal 1 of R_6 also is soldered to the potentiometer case. See fig. 1 and text for alternate connections for R_4 and C_3 .

THE J ANTENNA ON 6 METERS

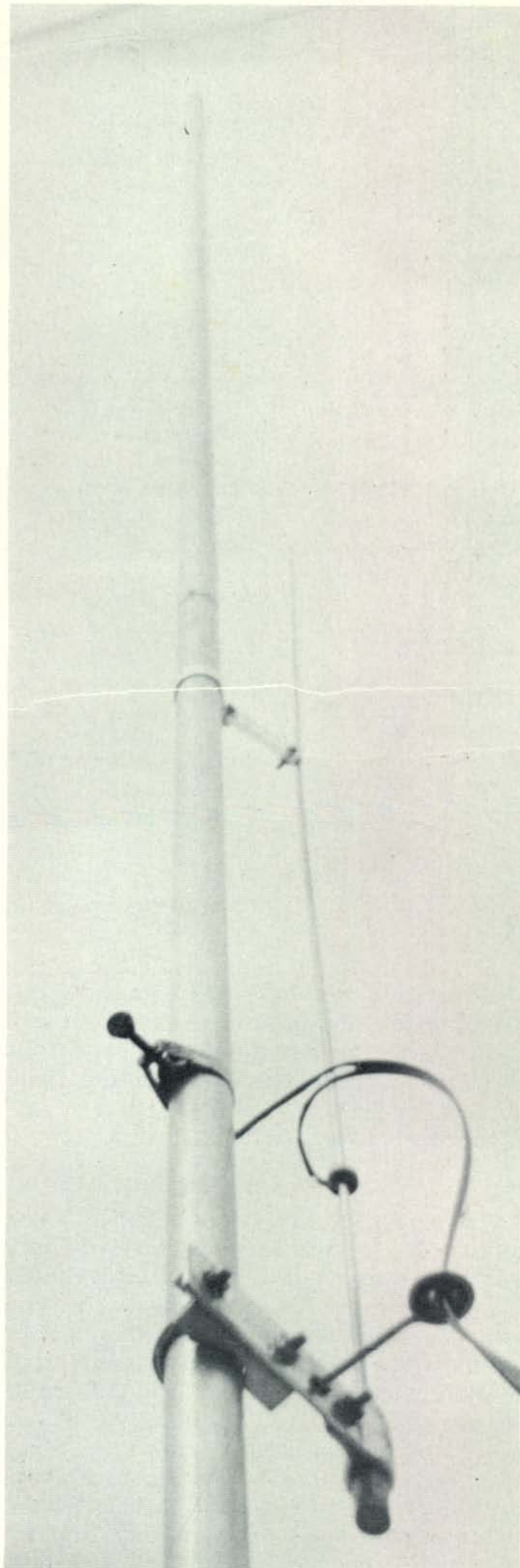
BYRON H. KRETZMAN, *W2JTP

THE NEED arose recently at W2JTP for a simple, light-weight, inexpensive and easily constructed antenna to receive the vertically-polarized f.m. signals on 52.525 mc, the national calling (and operating where activity is low) frequency for wide-band f.m.¹ To fulfill the basic requirements listed above, it was decided that ordinary, common, readily available TV hardware should be used. Secondly, while our 6 meter antenna should be simple and light-weight, it still should be rugged enough to withstand the winds encountered at chimney-top. This requirement eliminated the ground-plane antenna-fastening 54" radials securely was too complicated. It soon became obvious that the "J" antenna would nicely satisfy all of our requirements.

"J" Antenna History

There is nothing new about the "J" antenna, and it is the epitome of simplicity: A half wave vertical radiator fed at the bottom with a quarter wave matching stub, with one side of the stub a mechanical continuation of the antenna above. The matching stub can be fed with almost any kind of transmission line; open wire, twin lead, or coax, tapped on the stub at the optimum point, of course. We first used the "J" antenna on 5 meters, more than 30 years ago. There was no TV hardware in 1936. Our 5 meter "J" was made of #12 copper wire supported by a bamboo rug pole. And the feeder? There was no twin-lead or coax

* 431 Woodbury Road, Huntington, N.Y. 11743.
1 Kretzman, B. H., "FM Mobile Techniques," *CQ*, May 1966, pg 50.



The "J"—Antenna on 6-meters at W2JTP, self-supporting above the chimney clamps.

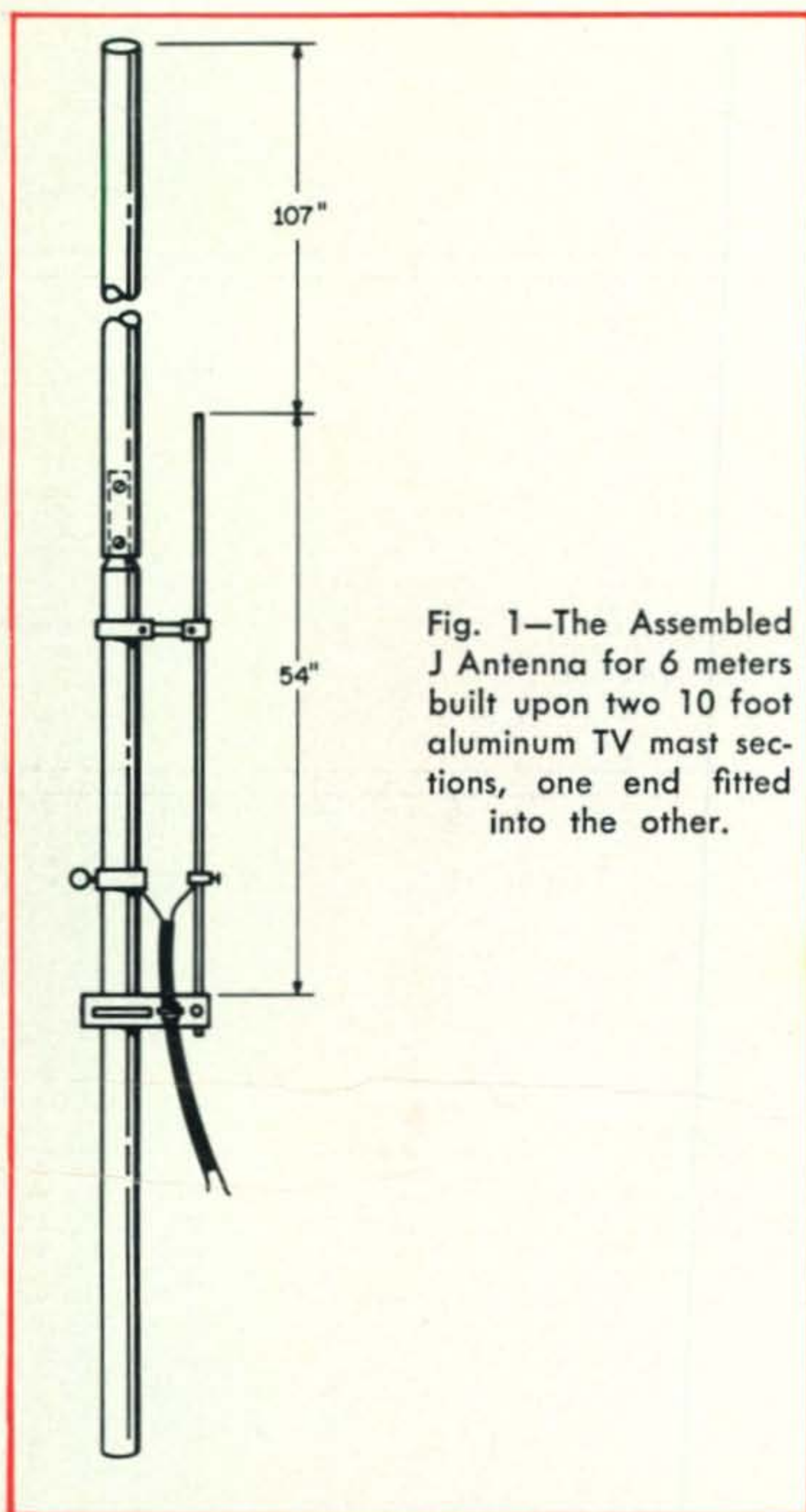


Fig. 1—The Assembled J Antenna for 6 meters built upon two 10 foot aluminum TV mast sections, one end fitted into the other.

in those days, but there *was* Lynch "Giant-Killer" cable. This was a heavy rubber and cloth covered twisted-pair made by Arthur H. Lynch W2DKJ (now W4DKJ) especially for use as perhaps the first practical low impedance r.f. transmission line for hams.

J Antenna, 1967

Our modern "J" antenna for 6 meters was constructed in one evening, with ordinary ham-workshop hand tools, and on the basis of two aluminum TV mast sections, the kind with one end swedged so that they can fit together. The matching stub was made from an old 6 meter mobile whip, but a piece of $\frac{1}{4}$ -inch aluminum rod or tubing could just as well have been used. A couple of pieces of scrap aluminum, and a piece of polystyrene or lucite, was used to support the whip out from the mast about 3 inches. TV twin-lead, supported by TV line insulators, is used to feed our antenna. Right after the twin-lead is brought into the house, a coaxial

balun is used to transform the feed down to coax, which is then run inside to feed the Motorola FMTR-80D transmitter/receiver.

Construction Details

When fitting together the two aluminum mast sections, don't depend on just friction to keep them together when the wind starts blowing. Use two or three sheet-metal screws randomly spaced to lock together the two mast sections. Hardened aluminum sheet-metal screws made by Reynolds might be available at your local hardware store. These won't rust, but be careful—they snap off quickly. Figure 1 shows the assembled antenna. Measure down 107 inches from the top and mark this spot with tape. This is where the top of the stub must reach.

Figure 2 shows the construction of the bottom "shorting bar." The material is $\frac{1}{8}$ inch aluminum roughly 1 inch wide. The shorting bar is clamped to the mast with a TV hardware "U" bolt. The whip was clamped by bending one end of the shorting bar around the bottom of the whip. A 10-24 aluminum bolt and nut (Reynolds, again) was used to clamp the whip tightly. We used a second nut as a jam-nut to keep this joint tight. A 4 inch TV feed-line insulator, one threaded with 10-32 machine screw threads, was mounted in the center of the shorting bar to support the feeder.

Figure 3 shows the details, in "exploded" form, of the insulator used to hold the matching stub in position so that it won't whip around in the wind. The actual insulator is a piece of $\frac{1}{4}$ inch thick polystyrene or lucite. A metal strap, made from $\frac{1}{32}$ -inch aluminum, clamps one end to the TV mast, and another clamps the other end to the whip. Aluminum screws and nuts

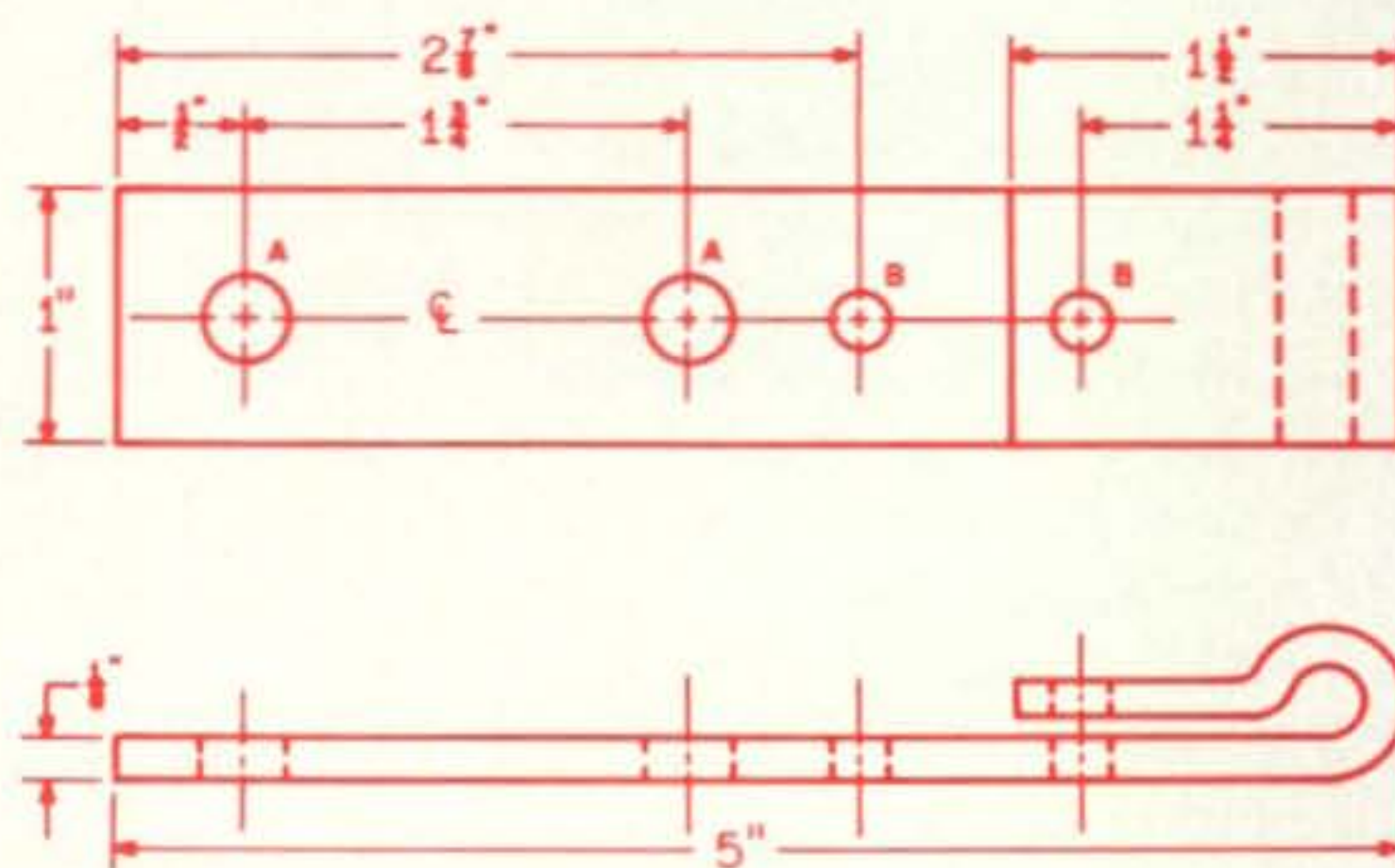


Fig. 2—Mechanical details of the shorting bar for the 6 meter J. The material is aluminum, $\frac{1}{8}$ inch thick.

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were used. The insulator was mounted about 30 inches above the shorting bar.

Attaching the 300 ohm twin-lead feeder to the matching stub was easy. We soldered a soldering lug, the kind with internal lock-washer teeth, to each end of the twin-lead. An ordinary hose clamp, such as available in auto supply stores, was used to clamp one lug to the TV mast. A brass dial shaft collar, with a brass set screw, was used to clamp the other lug to the whip. This system makes it very easy to slide the taps up and down when matching the feeder to the stub.

Feed and Balun

The TV twinlead feeder is supported with regular TV feeder insulators and the feeder is twisted to keep it from whipping around in the wind. Right after coming through the side of the house, into the basement, the balanced twinlead feeder is transformed to coax for the rest of the distance to the rig. Figure 4 shows the construction of the balun. Three type SO-239 (Amphenol 83-1R) coax chassis fittings were mounted side-by-side on a scrap piece of 1/8-inch thick aluminum. (Size is unimportant.) As shown, the center pins of two of these connectors were wired together with a piece of #12 wire. The balun was made of RG-59/U and is 71 inches long, tip-to-tip of the PL-259 (Amphenol 83-1SP) cable connectors.

Adjustments

Before mounting the antenna high on its TV chimney mounting brackets it was temporarily fastened to a stake on the ground so that the optimum position of the taps could be found. Now, the purists will scream that our match from the 52 ohm RG-8/U

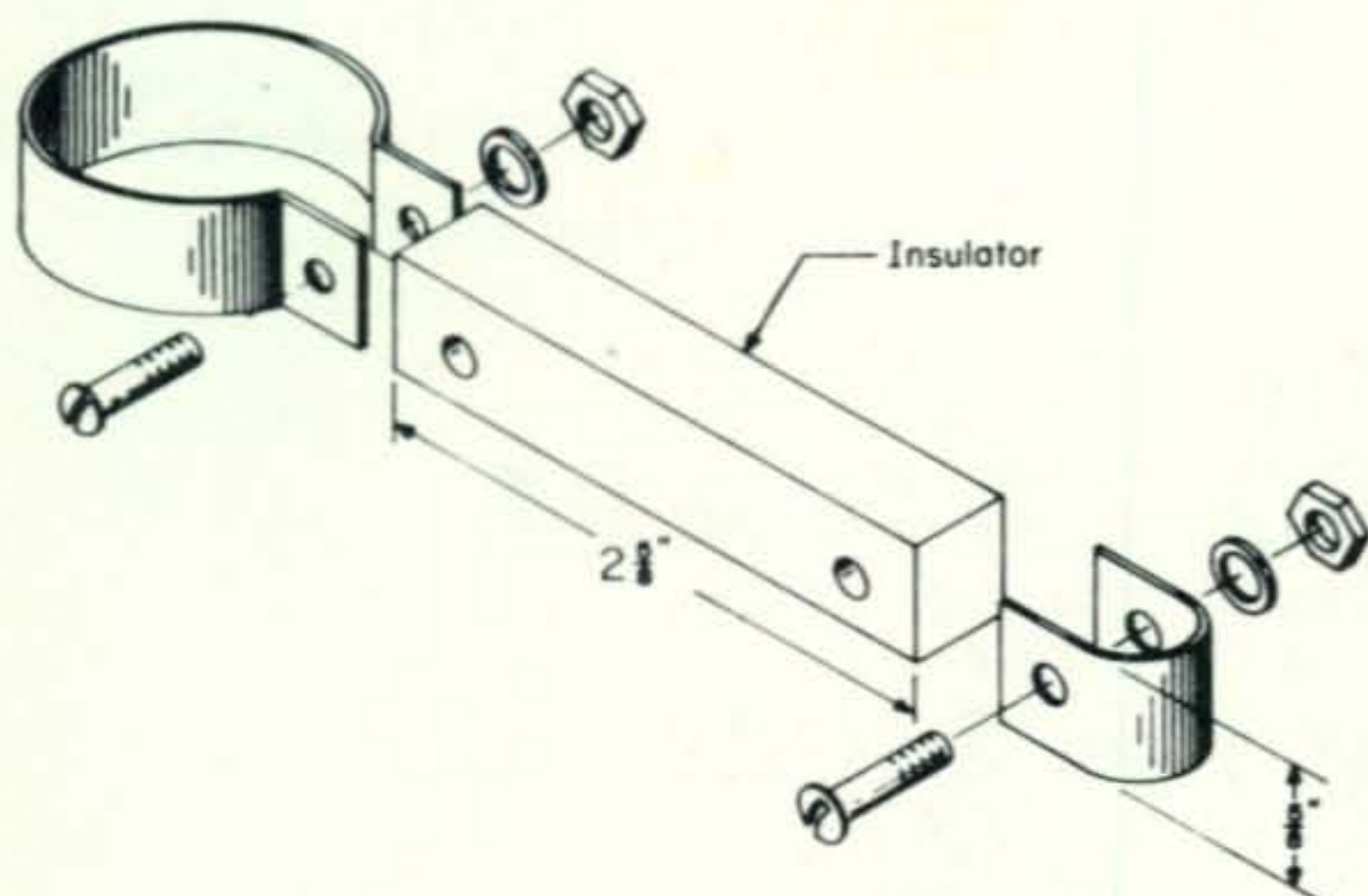


Fig. 3—An "exploded" view of the insulator for the matching stub of the 6 meter J antenna. All hardware is aluminum.

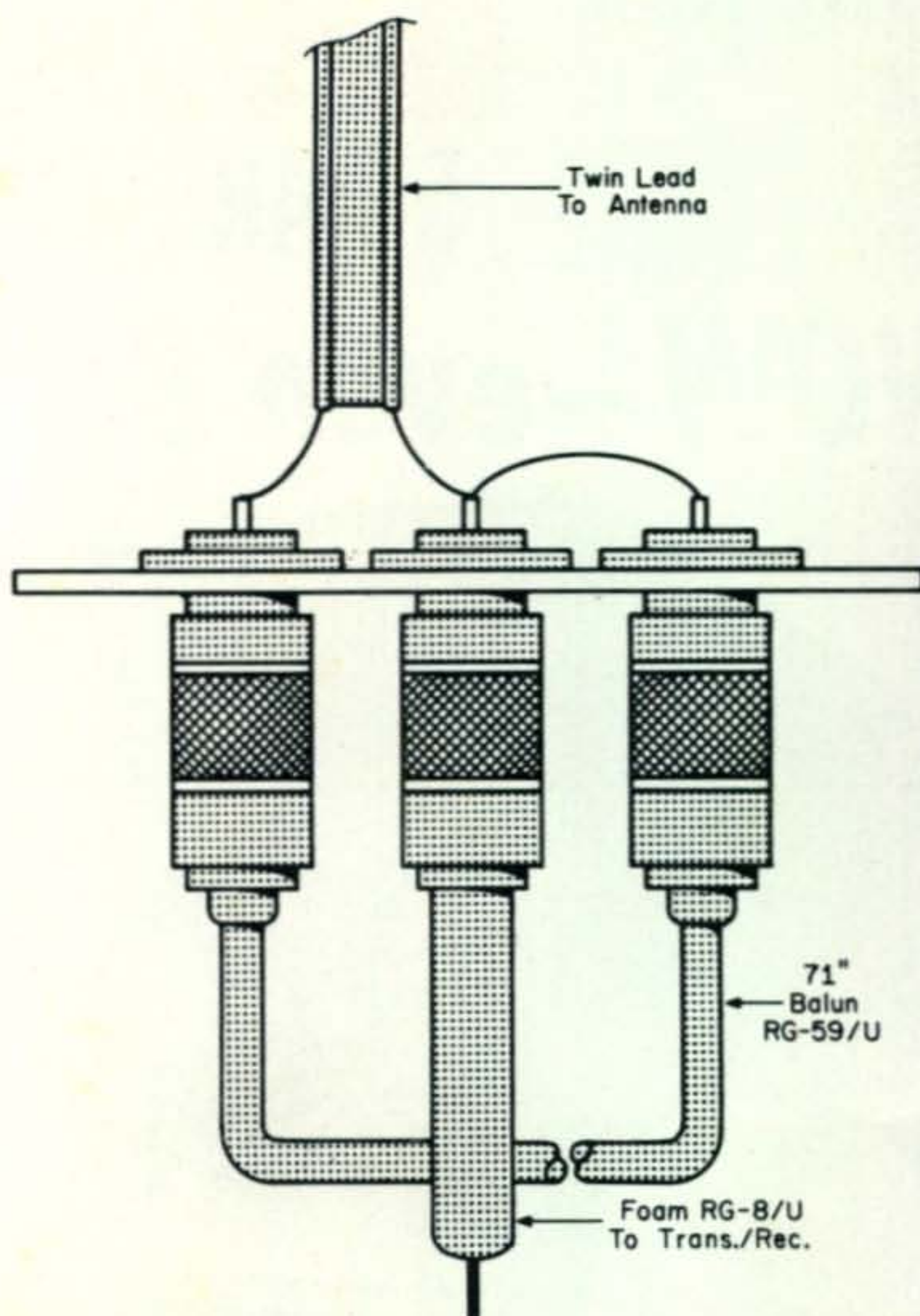


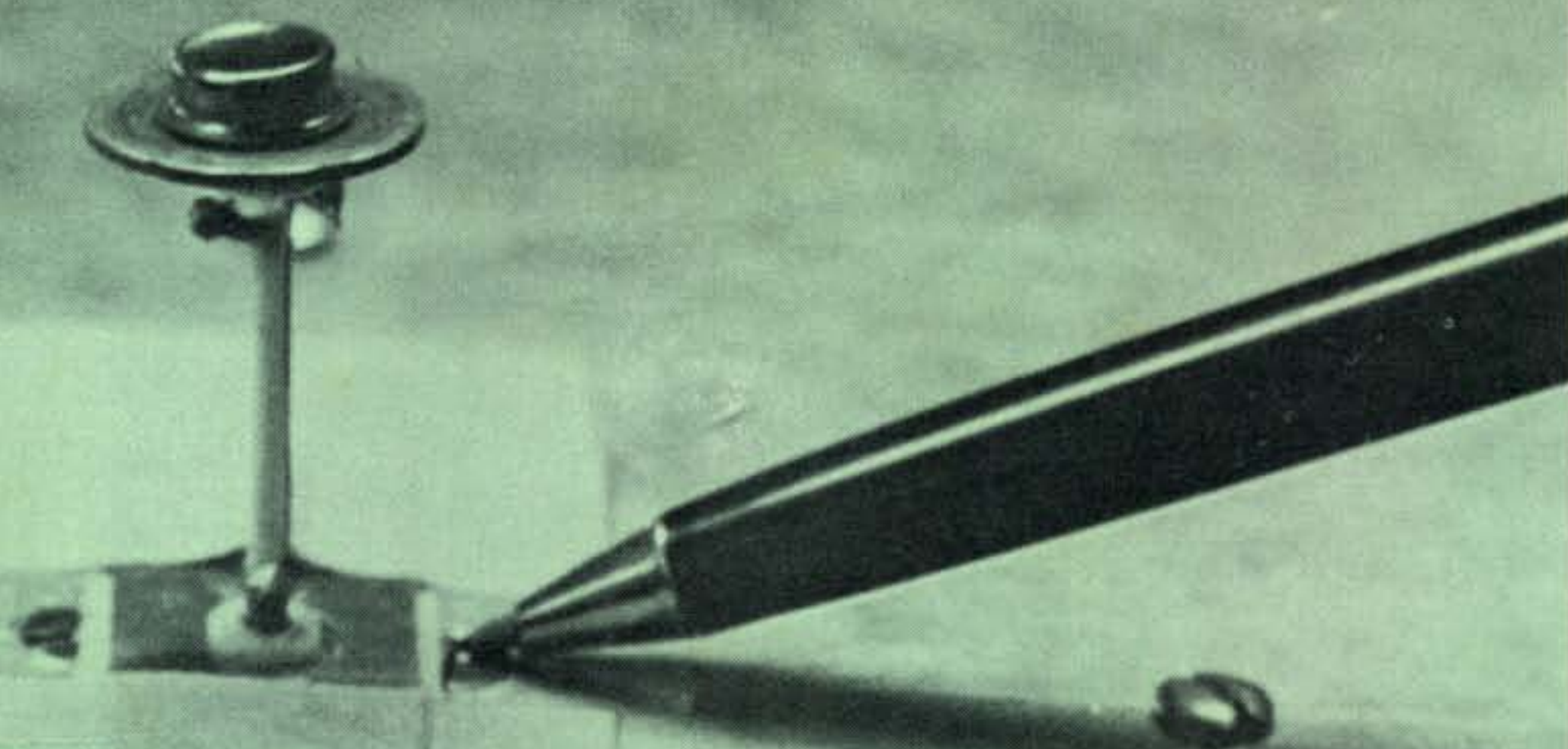
Fig. 4—Details of the balun transformation to go from the balanced twinlead to the unbalanced and lower impedance coax.

to the 300 ohm twinlead with the 73 ohm balun of RG-59/U is not exactly correct. Admitted. But it works; furthermore, we found that the balun could be also made out of RG-8/U, instead of RG-59/U, without seriously affecting performance. With a standing-wave ratio bridge in the coax line, we moved the taps up and down until the lowest s.w.r. was obtained. This optimum point was with the taps about 8 inches above the shorting bar. The v.s.w.r. measured was slightly less than 1.4 to 1.

Performance

Our 1967 J antenna was clamped to the chimney just below the shorting bar. The top of the TV masting is about 35 feet above the ground. The unsupported part of the masting does very little whipping around in the wind, even in strong winds. And no change in transmitter loading in wet weather has been observed although the cheapest of twin-lead was used. With a 30 watt base station it has been possible to work similarly equipped mobiles 30 miles out on eastern Long Island. The J antenna is *still* a good v.h.f. antenna, even after 30 years. ■

Laboratory test model of a subminiature integrated antenna one fiftieth the size of a conventional monopole antenna. Some experts claim it will perform the same for receiving as a full size $\frac{1}{4} \lambda$ monopole antenna. Photo courtesy of U.S. Air Force.



MINIATURIZED ANTENNAS

BY JOHN J. SCHULTZ,* W2EEY/1

PART II

Part II of this article discusses miniaturized transmitting antennas. Unlike miniature receiving antennas which still can perform well by using them with sensitive receiving equipment, transmitting antennas themselves must be made as efficient as possible since amateur power limitations are based upon transmitter input power and not radiated power.

UNLIKE a receiving antenna where the objective is to extract power from an antenna, the objective with a transmitting antenna is to put power from a transmitter into it. However, the power must not simply be transferred to the antenna but it must *radiate* to be useful. That some form of antenna loads a transmitter properly is absolutely no indication that the power is being radiated.

A short transmitting antenna can be regarded, as shown in fig. 7, as a resistance in series with a capacitive reactance. To transfer maximum power to the antenna, the reactance must be matched by an equal inductive reactance and the source resistance

antenna. The antenna resistance, however, has several parts to it. One part is the so called radiation resistance of the antenna; the power dissipated in this conceptual resistance is all radiated and the objective, naturally, is to get all the power into it somehow. Another part of the resistance is representative of the heating losses in the antenna elements. Such losses are fine to melt ice on an antenna but don't help to radiate the input power. Generally, in miniature antennas, these losses are the easiest to reduce by simply using large diameter tubing for the antenna element.

Another part of the resistance represents a loss which is actually not part of the antenna proper but can be considered to be part of it for convenience. It is the

* 40 Rossie Street, Mystic, Connecticut 06355.
must be the same as the resistance of the

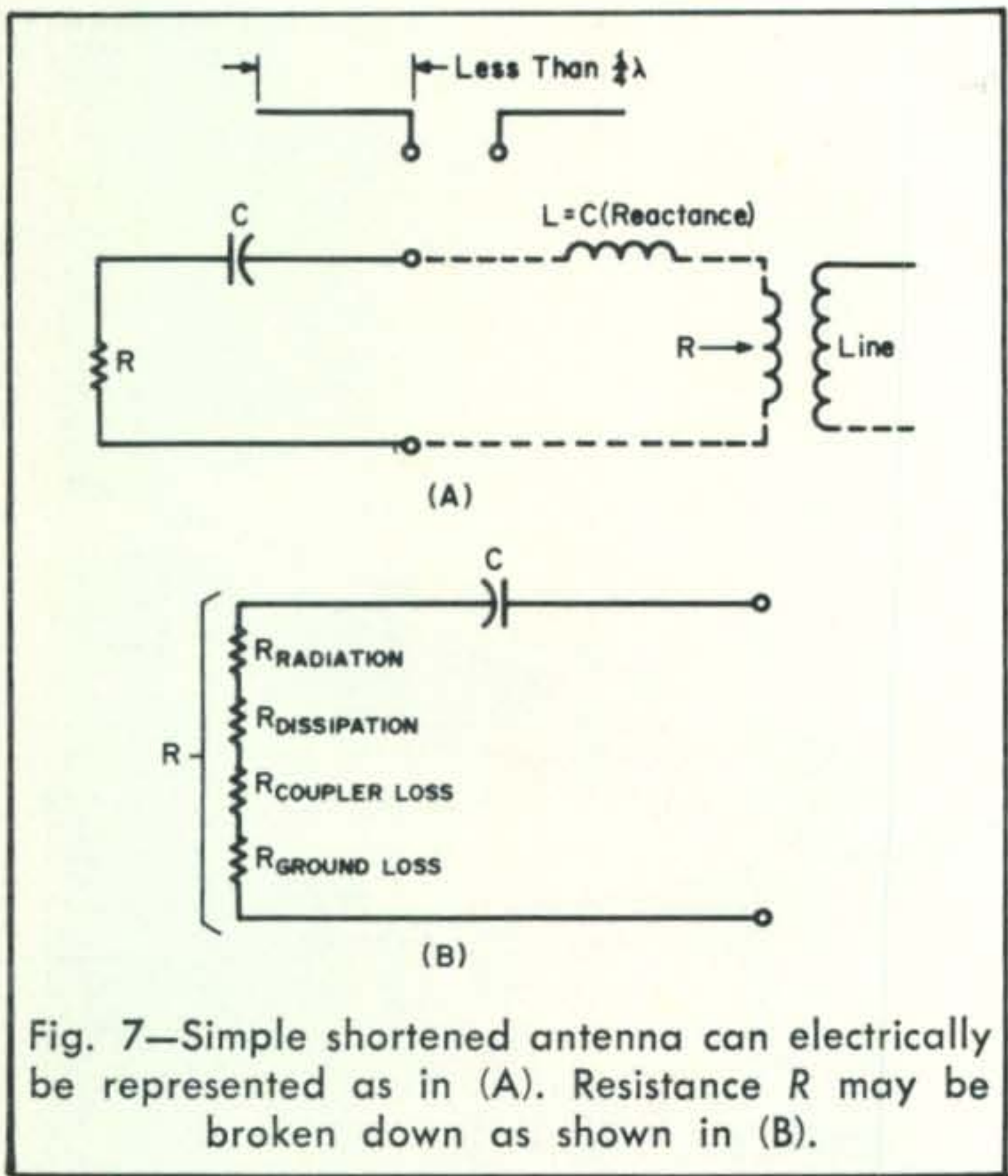


Fig. 7—Simple shortened antenna can electrically be represented as in (A). Resistance R may be broken down as shown in (B).

dissipation losses of the antenna coupler used to match a transmission line or transmitter to the relatively high impedance of a short antenna. Large currents flow in the inductive elements of such a coupler and unfortunately it is rarely practical or economical to make the losses small by using heavier conductors (winding coils from 2" diameter tubing, for example). If the antenna is connected to a ground system, there will also be losses associated with current flow in the lossy ground and can be represented by another loss resistance. Current flowing in an antenna must encounter all of these resistive elements which will dissipate power. There is no magic to producing an efficient, miniaturized antenna—the loss resistance must be effectively

eliminated or the radiation resistance must be raised so, in comparison, loss resistances are insignificant.

The efficiency of an antenna can be stated as follows in terms of resistances:

$$Efficiency = \frac{R_{rad.}}{R_{rad.} + R_{diss.} + R_{gnd. loss} + R_{coup. loss}}$$

If the losses can be reduced to zero, even a 1" piece of wire fed 1KW will radiate 1KW. Note, however, that although reducing any one loss will improve efficiency, all losses must be brought down to a small fraction of the radiation resistance to produce and real efficiency. The difficulty in doing this can be appreciated from fig. 8 which shows the radiation resistance variation for a short antenna.

Eliminating Losses

Probably the most direct approach to reducing various losses is to make everything bigger and better. Antenna elements are made of large diameter tubing and couplers employ large, silver-plated inductors. The various surplus antenna tuning units available generally demonstrate this approach. The "brute-force" approach technique can produce good results, but at a price. A 20 foot dipole used on 40 meters and made of #14 wire with an antenna coupler employing similar size wire should produce a signal several "S" units less than a similar antenna made with 2" diameter tubing and with a coupler with 1" diameter tubing coils.

For short antennas, ground losses can be a very deceptive factor since rarely is a ground what it appears to be. Even the ohm or so encountered in a heavy ground wire or piping before a real electrical ground is reached can drastically reduce the efficiency of a very short antenna. Generally, it is better to use some form of balanced short antenna and avoid any dependence upon a ground connection unless one can build an extensive artificial ground system and couple directly to it. There will always be some radiation coupling to a lossy environment (such as when an antenna is used inside a building) but still there is no sense in sending the available power directly into a lossy ground in a building.

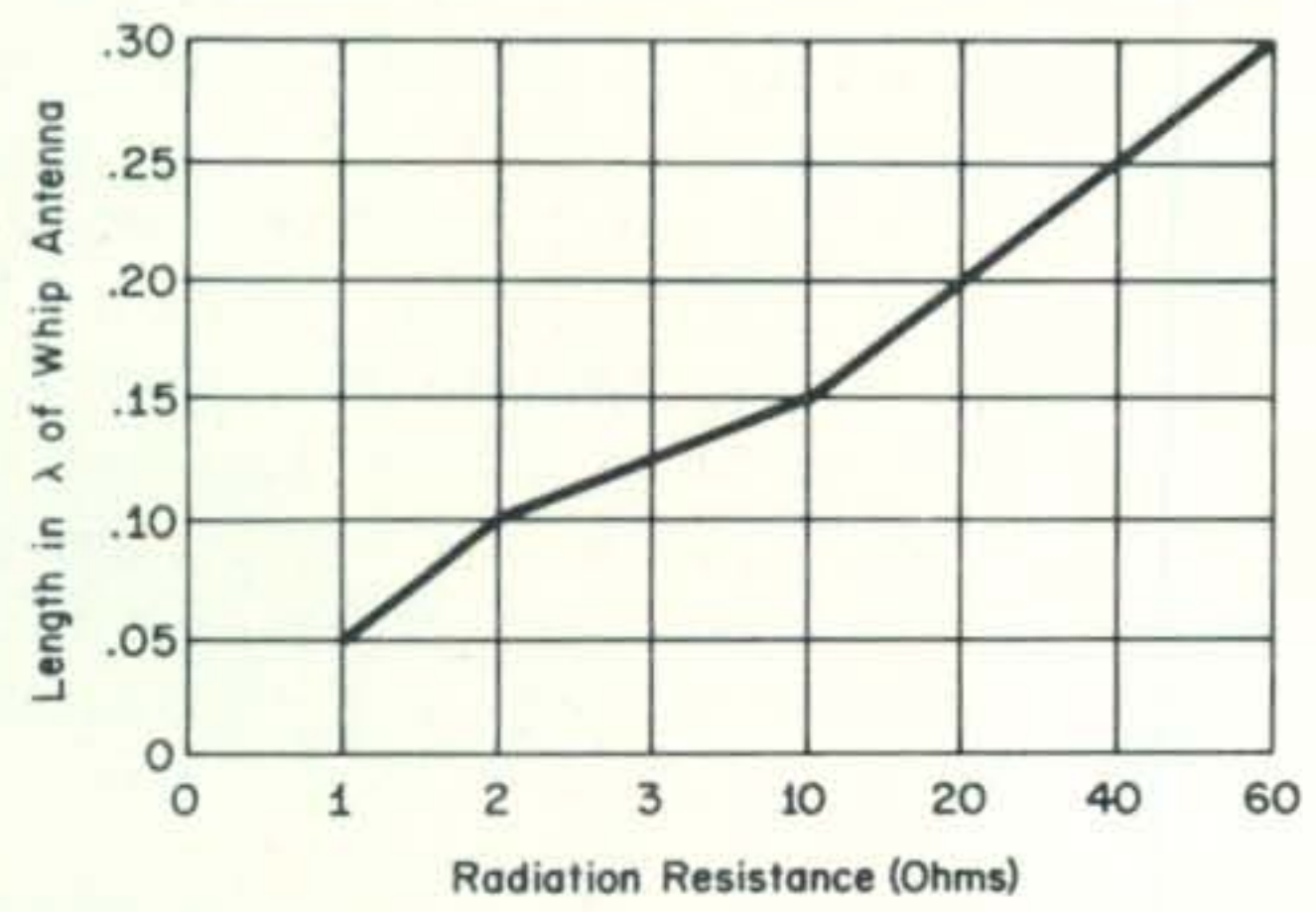


Fig. 8—Radiation resistance of a shortened antenna falls rapidly, particularly below 0.15 λ. Bend in curve is due to scale used; actual variation is smooth.

One interesting approach to reducing antenna coupler losses by reducing the resistance of the elements without creating out-sized coils is actually to cool the elements. Resistance of certain metals will fall to zero at temperatures below 20°K and are said to be "superconducting". Absolute superconductivity cannot be achieved but cryogenic systems can cool the coils in an antenna coupler enough to produce dramatic increases in efficiency.

As the resistance is reduced dissipative losses become smaller and, all other things being equal, antenna efficiency rises as more power is actually absorbed by the antenna radiation resistance. Dramatic cooling with various metals is not necessary to produce noticeable results. Even a slight reduction in temperature, 20% below normal, can improve efficiency several db when short antennas of $1/10 \lambda$ or less are used. A great deal of experimentation is being conducted in the field of cryogenic cooling of antenna elements and the questions regarding it concern more the practical rather than the theoretical aspects. It will probably be one of the most useful developments for miniaturized transmitting antennas if compact and economical cryogenic coolers are developed.

Whatever the means employed to reduce losses, it must be remembered that *all* losses must be reduced to produce an efficient antenna.

Raising Radiation Resistance

If one could make a 10 foot dipole with a radiation resistance of 50 ohms on 40 meters, with small or no capacitive reactance, loss resistances would be small in comparison and excellent efficiency should be obtained. Things would be this way if it were not for the fact that what is usually done to raise radiation resistance introduces losses of its own and the seeming advantage that should result is lost (fig. 9). Inductive loading of an antenna is the most common example. The loading coil whether placed at the base, middle or extremity of an antenna element serves to raise radiation resistance because it makes the antenna longer but the current flowing in the lumped inductance creates a new loss which diverts the input power.

Generally, center loading is used as a compromise between electrical and mechanical considerations. The greatest current, or at least a small part of it, which occurs at the base of a $1/4 \lambda$ or shorter whip (or dipole

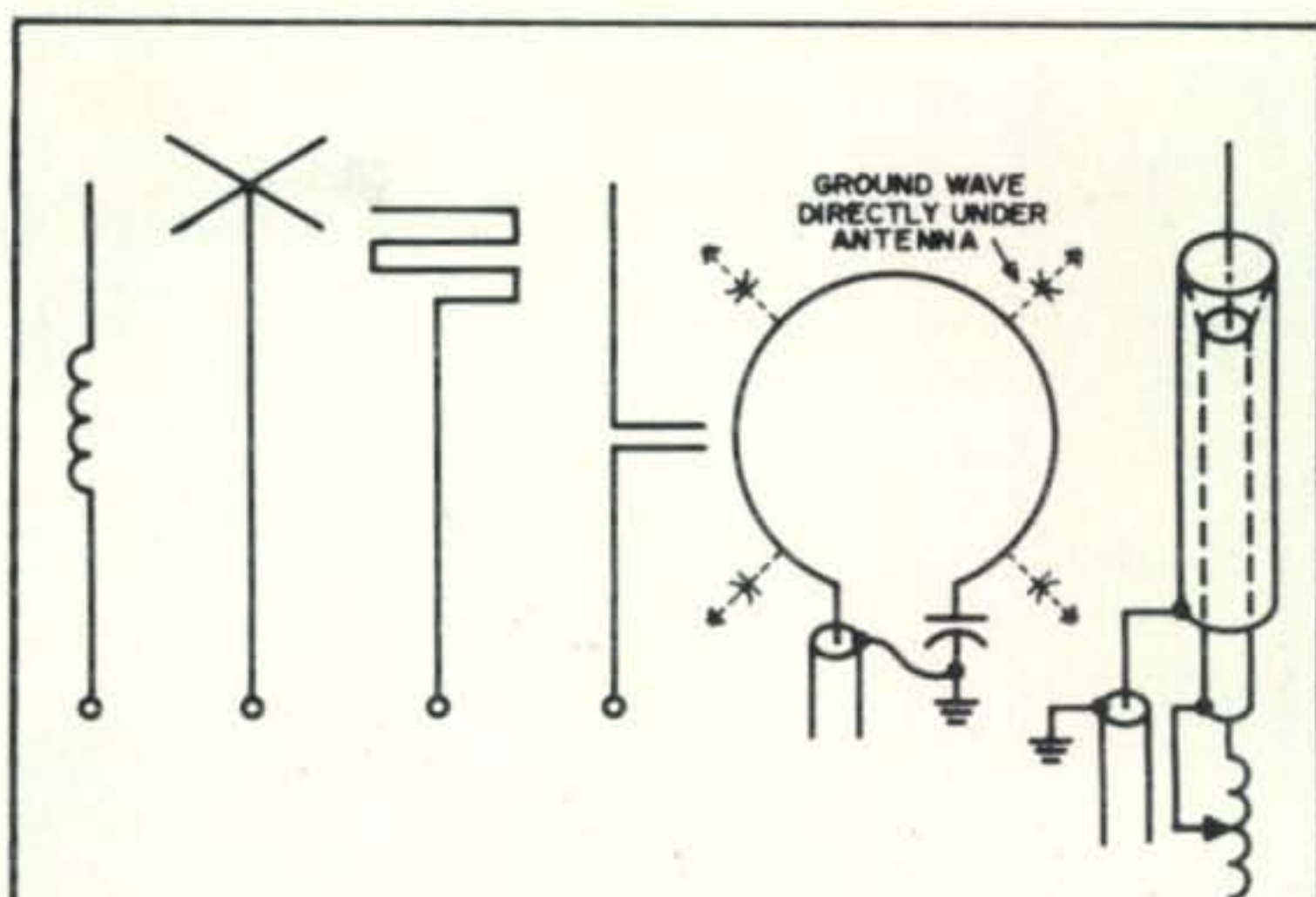


Fig. 9—Various forms that lumped reactive loading can take. Unbalanced forms are shown but balanced types would have another identical element with loading. With 8' heights efficiencies are about 2-5% on 80 meters in a typical installation.

element shorter than $1/4 \lambda$) flows through low resistance tubing and the current is reduced somewhat by the time it encounters the lumped inductance. Large end-loading coils would be preferable but are precluded, as a rule, by mechanical considerations. The coils are usually made of the lowest loss material possible but since their inductance must be considerable on the lower frequency bands where short antennas, 8 foot whips, for instance, are used, their Q become high and make the antenna system resonate (capacitive reactance minimum) over a frequency spread of as little as 10-15 kc. Probably as far as most base and center loaded antennas are concerned, the same radiation efficiency could be obtained by use of a hefty antenna coupler without loading the antenna although the same problem of narrow bandwidth operation, unless retuning is done, would remain.

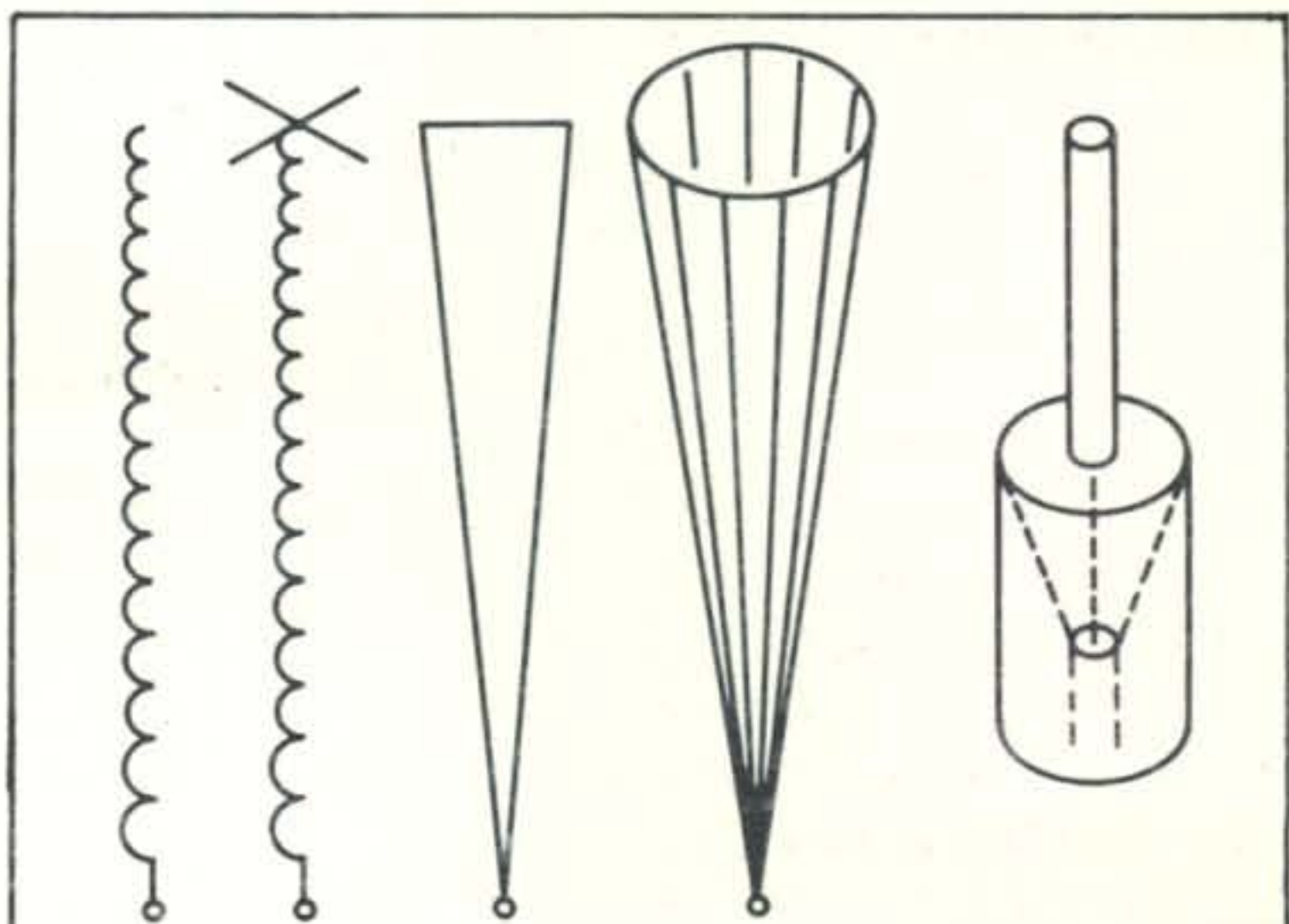


Fig. 10—Various forms of distributed and combined reactive loading. Efficiency is raised above forms shown in fig. 3.

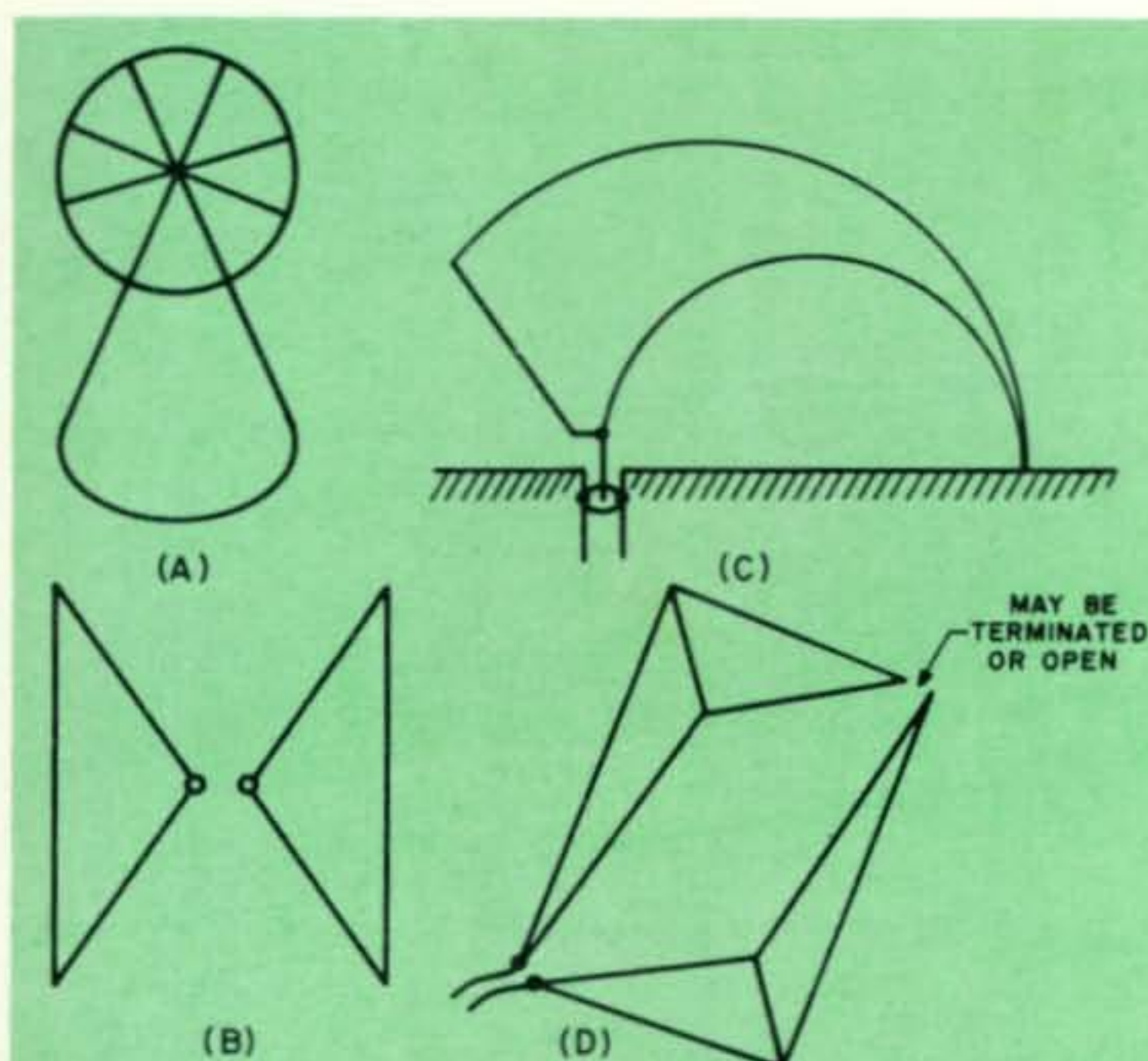


Fig. 11—Discone (A) and bowtie (B) are not really miniature antennas since they are quite large. Other forms (C and D) exhibit resonance even when their side lengths are 0.1λ or less; their efficiency, however, has not yet been determined.

Capacity top-hat loading works much the same as inductive loading except that the Q is lower and bandwidth restrictions are not as severe. Large capacity top-hats are generally impractical for mobile installations but a very desirable method for raising the radiation efficiency for a fixed antenna.

Stub loading, particularly inductive loading, suffers from the same difficulty as lumped constant inductive loading in that the Q must be reasonably high for efficiency and this in turn creates a very narrowband antenna when there is no additional tuning circuit at the terminals of the antenna to re-resonate the antenna. However, besides being used as stubs, transmission lines can perform another function in shortened antenna systems and that is to transform (or really transfer) the lumped constant loading which would be usually electrically and physically present at the center of the antenna, physically to the base terminals of the antenna or even to a further remote location, if desired. The transmission line electrically transfers the effect of the larger, lower-loss remote loading reactance to the center of the antenna. The loss in the transmission line is extremely low as long as its length is not too great and if a line with a low attenuation at the frequency of operation is used since it operates with a fairly high s.w.r. Efficiency is raised over a system where part of the loading is in the center or end of an antenna and another part (adjusta-

ble to permit retuning with frequency changes) is located at the base of the antenna.

Distributed Loading

If the problem with lumped constant loading is that high Q restricts bandwidth and its placement in an antenna produces high losses because a major portion of the antenna current passes through it, an obvious solution is to distribute the loading so only a portion of it is affected by the higher current portions of the antenna. Probably the oldest scheme used to do this is the helical antenna where the winding is tapered to produce less turns towards the terminal of the antenna (fig. 10). The helical (with capacity top-hat loading when possible) is still the basic form used for many general purpose high-frequency antennas when surface dimensions are restricted. Some types use taps on the helical turns to change frequency while others use a wide-range antenna coupler of hefty construction at the terminal of the antenna.

When surface dimensions are not restricted, the antenna elements can be fanned out to produce a form of distributed capacity loading. If the elements are fanned out to extremes the overall linear dimension to achieve resonance becomes less than a normal $\frac{1}{4} \lambda$ and the element remains resonant over a wide frequency range. The TV bowtie antenna is an example of such a form. With a shortened antenna fanning the elements will help efficiency since the elements will behave as though they were made of a larger diameter.

If the distributed loading of an antenna changed somehow with frequency so as always to keep the antenna resonant, there would be no need for antenna couplers and if the radiation resistance remained reasonably high and constant, the antenna would be efficient. The search for an antenna to fulfill this goal has led to forms which might be considered to have been derived from modern art. The discone antenna is one well known form (fig. 11) although its side dimensions must still be about $2/10 \lambda$ at the lowest frequency of operation which hardly puts it in the miniature category. Other forms have been experimented with which seem to exhibit wide resonance with linear dimensions of less than $1/10 \lambda$. No standardized dimensions have yet been developed for some of these forms (fig. 11) nor has

their efficiency been fully explored. One factor that discourages experimentation with such forms that invariably the radiation pattern changes wildly over the frequency range which the antenna is resonant. The power may be radiated but in useless directions. The best that can be said for "form" antennas at the moment is that they can produce interesting exercise for an experimenter's imagination.

Antenna Placement

Basically, relatively little power is radiated from a shortened antenna and so poor placement can often take care of the rest. For instance, most people who have used window type loaded whips notice that best results are achieved when the whip is at right angles to the window. Having the antenna oriented in the same plane as any lossy medium tends to produce maximum coupling between the antenna and that medium. The window example is a simple one but in a complex situation, such as an indoor antenna, the only way to find the best antenna orientation is by measuring the signal strength or receiving comparison reception reports. Antenna loading is not a useful indication.

Getting even an inefficient antenna high and in the clear will generally prove better than a larger antenna in a very closed-in or indoor location. There is, however, no way to predict which situation is better because of the many variables involved in any specific setup.

Feeding the Antenna

Often it is not possible to place a matching network directly at the base of an antenna either because of remote control difficulties or because of physical limitations. For instance, fig. 12 shows a short whip fed by coaxial cable with a remote antenna tuner. The variation in impedance of the whip will be such that the s.w.r. on the coaxial line will vary over the high frequency bands from a low of 1:1 to perhaps 20:1. If the coaxial cable used has a normal loss of 3 db for the length used at a particular frequency, the additional loss because of the 20:1 s.w.r. will be about 6½ db. Using a lower loss cable, one that has a normal loss of 0.7 db, for instance, will reduce the additional loss to 3½ db because of the high s.w.r. Thus, just by using a lower loss cable, the power lost in the transmission line has

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Fig. 12—When long cable run is involved between an untuned antenna and coupler, low loss cable is necessary for efficiency. Small cables such as RG-58 and RG-59 should not be used. With low loss cable and a good ground, efficiency of the system shown will vary between 5 to 80% from 3 to 30 mc.

been cut in half and is available for radiation.

The important point to remember is to use the lowest loss transmission line available whenever the transmission line cannot be matched to the antenna terminals.

Conclusions

This article has not tried to present any detailed technical analysis of all the factors involved in creating an efficient miniaturized transmitting antenna. However, it is hoped that no matter what form of small antenna the reader may use he will be aware of some of the factors that affect efficiency and be guided to concentrate his efforts towards the most useful means of improving his antenna. For some installations, this might mean different size antenna elements, a more efficient coupler, better ground connection, use of a balanced antenna or even another form of antenna.

The author knows of no really efficient short and cheap antenna. Commercial and military interests have many brilliant people at work on the problem and the best that seems to have evolved so far have been either specialized or very expensive solutions for equally specialized and expensive applications. While it is true that even a simple short antenna, used when the band is right, or placed in a location so that it excites other structures (the radiation is enforced) will occasionally produce good results; these results are not a function of the antenna itself being efficient. ■

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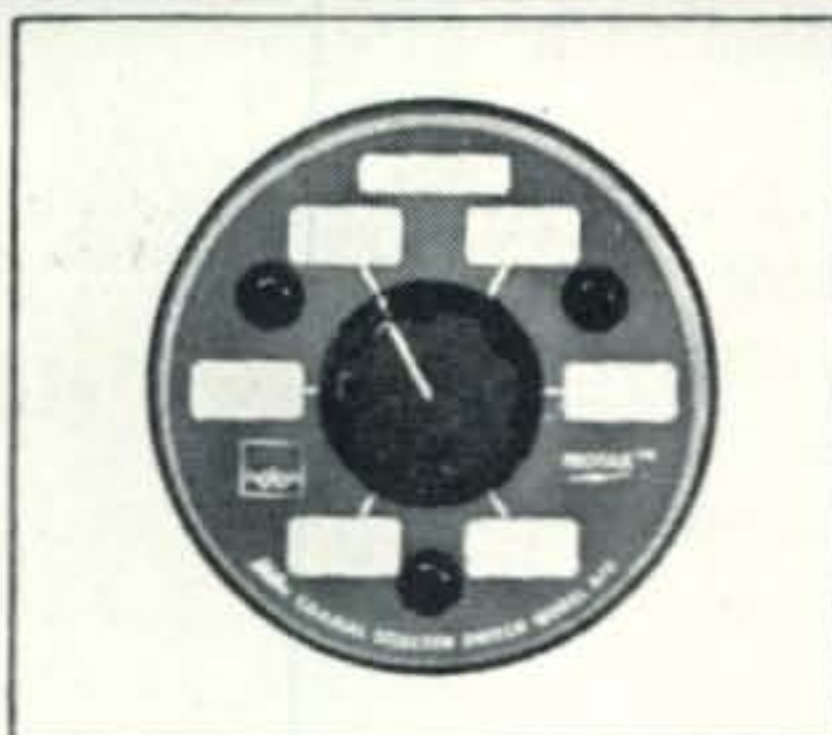
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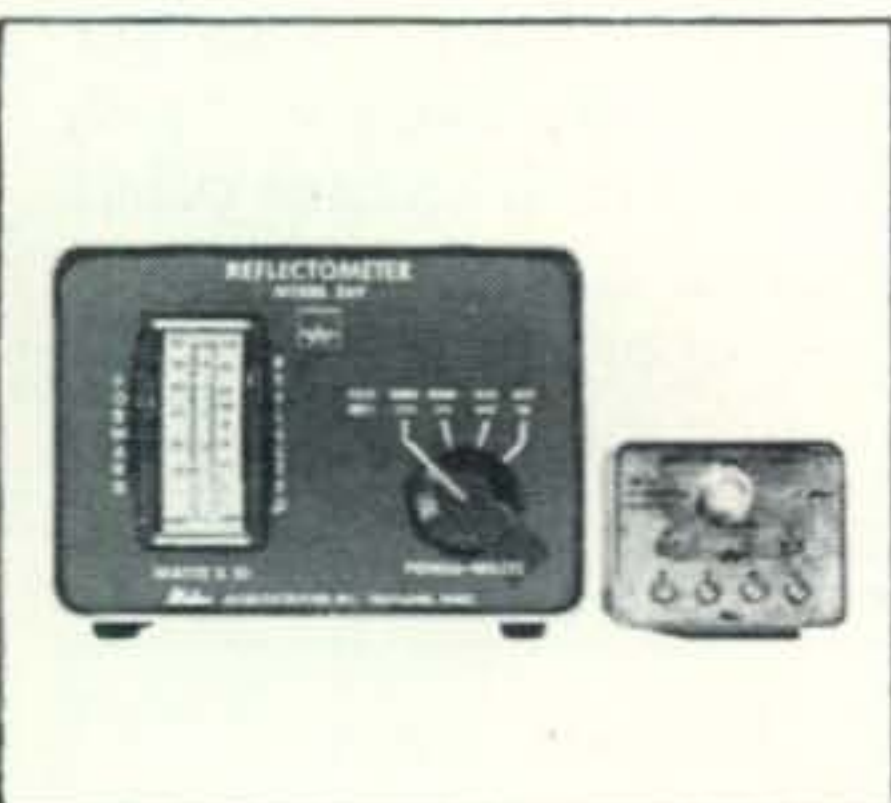
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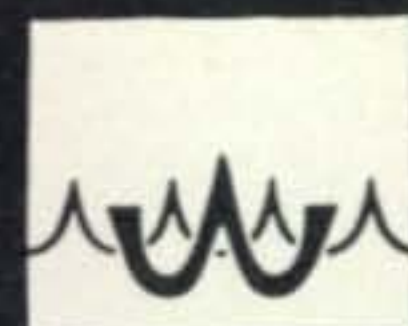
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Front view of the v.f.o. The toggles are for On-Off and Standby.

BY E. H. MARRINER,* W6BLZ

BRUEGHEL, one of the old masters, was so bemused at the human propensity for ignoring great events that he painted a canvas in whose foreground, a peasant solidly plowed his field, while in the background Icarus ends his legendary flight by plunging into the Aegean Sea unnoticed by the workaday world. Perhaps I, like the plowman, ignore the great things being done with transistors, and still plug away using my cache of tubes which are available and cheap. I suppose transistors are nice if you have them around in a quantity to experiment; the average amateur does not.

Great things are published about transistor v.f.o.'s. You see the circuit in print, and you see a picture of the finished product, so they must work; but for what applications? Being a c.w. nut, I like to key my final amplifier, and the changing load on the transistor v.f.o. reflects down the line of tran-

sistors and makes the note "chirpy." A cathode follower between the stages does not help. Another problem arises when using a transistor v.f.o. on the same frequency as the amplifier. The r.f. on the chassis disrupts the oscillator note. One of the new gadgets on the market are the f.e.t.'s, but they still won't take any undue r.f. and so develop internal leakage. Don't let me discourage you, let's just say I have spent a lot of time trying to make a transistor v.f.o. work for my c.w. rig, and my heart breaks to put the jug of etching solution under the bench. Besides it cost me \$2.95 to have it shipped out from the mid-west so I could get started. Thus after a long frustration I am back to the tube v.f.o. for my c.w. rig, and I think most c.w. amateurs will find the v.f.o. much easier to make oscillate. One of the problems with a transistor v.f.o. is the tendency to stop oscillating when too much tuning capacity is placed across the coil, and the toroid coils have to be picked for the proper tuning

* 528 Colema Street, La Jolla, California.

range. If you have my problem, here is a solution.

Tube V.F.O.

This v.f.o. uses cathode follower output to isolate the oscillator circuit, and the output voltage is about 3 volts of r.f. which plugs into the transmitter's crystal socket. More output can be obtained if necessary by changing the cathode follower tube into a tuned amplifier and taking the output voltage from the plate of the tube through a capacitor. This will require a tuned circuit to manipulate if the frequency is changed and it is necessary to keep the stage in tune.

Circuit

The circuit shown in figure 1 is a straight forward Clapp oscillator using one half of a 12AU7. The second half of the 12AU7 serves as a cathode follower to provide some degree of isolation. The power supply uses half wave rectification with an RC filter. The capacitor is a triple 40 mf unit with all three sections paralleled.

The output is connected to the transmitter

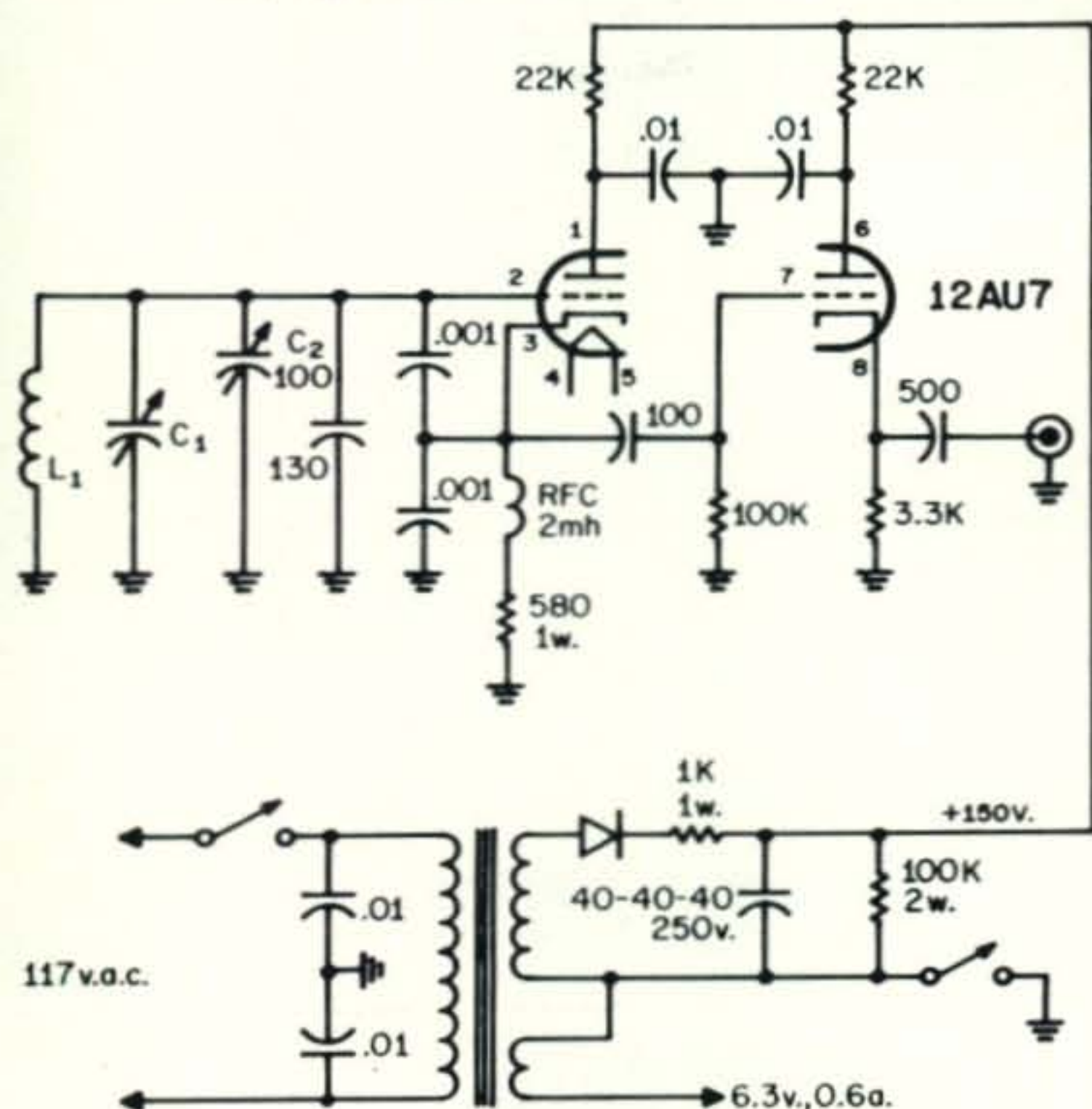


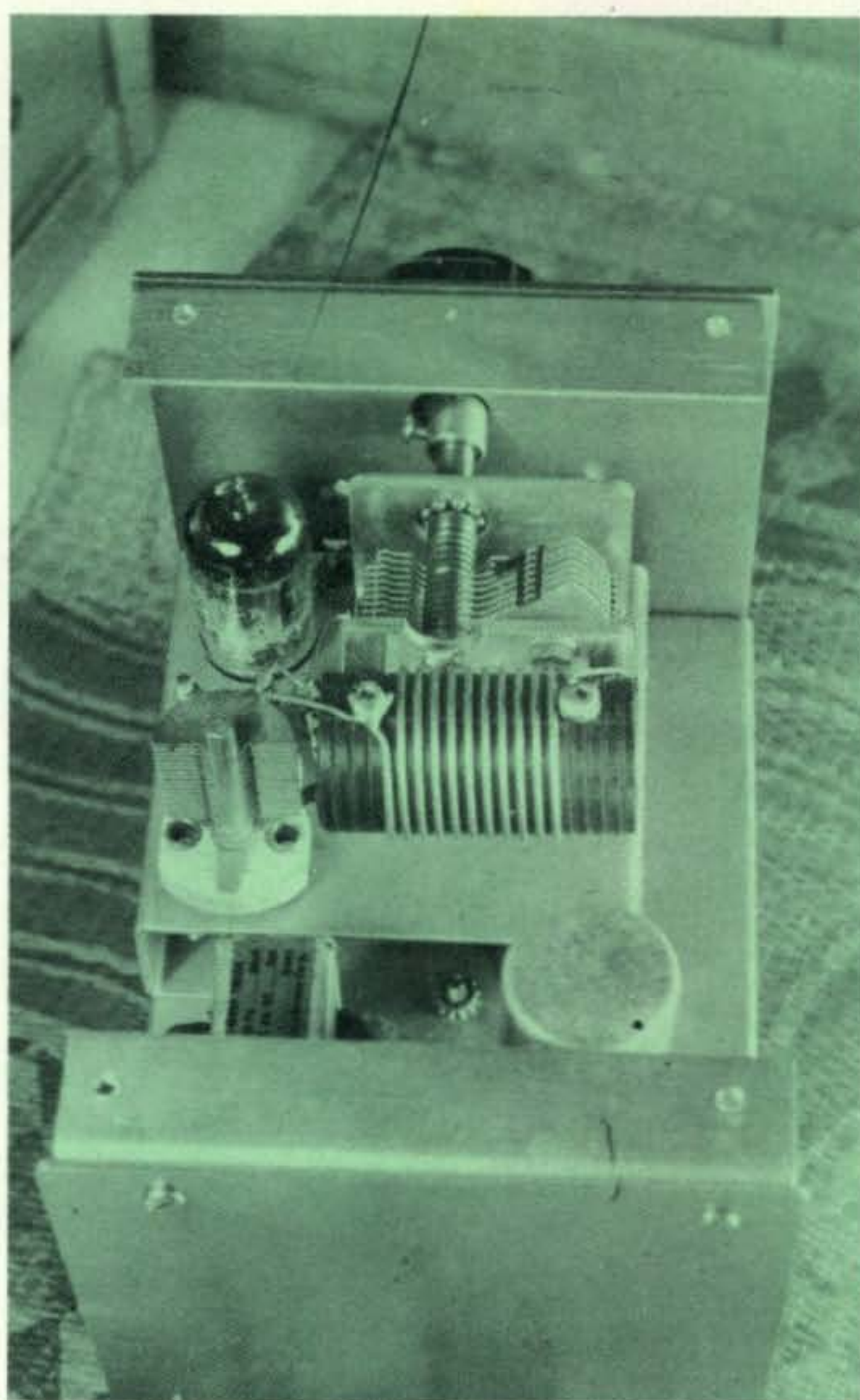
Fig. 1—Circuit of a 3.5 mc v.f.o. The three fixed capacitors in the grid circuit of the oscillator section are all silver micas. All capacitors are in mmf and all resistors are 1/2 watt except where otherwise noted.

C₁—365 mmf broadcast variable. J. W. Miller #2111 or equiv.

CR₁—400 P.I.V. at 50 ma or more.

L₁—11 turns #20 on 1" dia. form, wire spaced.

T₁—125 v.a.c. at 15 ma. Stancor PS-8415 or equiv.



Rear view of the interior of the 3.5 mc v.f.o. shows the oscillator coil mounted on the rear of the tuning capacitor, C₁. The padding capacitor, C₂, is mounted vertically to the left of the coil.

crystal socket via a short length of RG-174, 50 ohm coax. The r.f.c. in the cathode of the oscillator is a J.W. Miller #6302.

Construction

The v.f.o. is mounted on a California Chassis Type A-137, size 6 x 4 x 1 1/2 inches. The power supply is mounted on this chassis but the v.f.o. wiring was done on a little 2 x 2 chassis but it could be built right on the chassis with the power supply if so desired.

Bandspreading

The easiest way to bandspread the v.f.o. is to find out where the tuning range is located and start pulling out rotor plates from C₁ to give the most bandspread for your particular use. As the plates are pulled out, the padding capacitor, C₂, will have to be increased. For the range 3500-3700 kc, the rotor was left with 8 plates for proper tuning. ■



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New Readers Service on Page 120

December, 1967 • CQ • 43

PROJECT MOONRAY

Ham Transpower On The Moon Gains Momentum

PROJECT MOONRAY needs your advice. July *CQ* featured an article outlining the goals of Moonray, and the reasons for the optimistic outlook of the sponsoring Nastar* group from New York. Nastar has every reason to believe that amateurs can and will place a complete v.h.f. repeater station *on the Moon* some time in 1971! The group has been given "The Word" by NASA that space is likely to be available on the third LEM moonshot for a ham repeater or transponder.

This support is not given lightly. One requirement of the repeater package is that it be operable as a "last-ditch" back-up communications system for the lunar astronauts. Another is that it must function as a "site re-locator" for future manned lunar probes. So obviously, Project MOONRAY serves first as another building block in the enormously complex LEM system, and second as an amateur radio transponder.

Official support, promised equipment and promised services for MOONRAY have already reached such proportions that it now becomes necessary to plan the actual physical and electrical configuration of the package. Certain parameters are automatically dictated by the NASA-suggested weight, shape and size limits. (Weight—5 pounds with 3 pounds allocated to a long-life isotopic power supply; Size—250 cubic inches with 100 cubic inches devoted to power supply).

Other parameters must now be determined by a carefully analyzed poll of the

amateurs who will eventually design and build MOONRAY, and more important, those who will use it. That's you! To help finalize MOONRAY specs, Nastar needs answers to the questions below. They need your advice—your opinions—the opinions of your club and your on-the-air friends. After all, *you* will eventually have to build equipment compatible with MOONRAY's parameters.

Here are the two most important questions requiring "user answers":

A-What mode of operation should be used? Should it be:

1) A 50 kc wide translator with shared power output similar to OSCAR III, handling all types of transmission, (s.s.b., a.m., f.m., c.w., FSK, m.c.w., etc.).

2) Or should it be a narrow-band, single frequency, medium power output unit for c.w. only? In this case what total bandwidth should we have, say, between 100 c.p.s. and 1 kc?

3) Or should it be a pulsed unit with relatively high-power and with which high-speed c.w. at relatively short duty cycles could be used for short periods?

4) Or some other mode of operation?

B-What operating band (or bands) should be used?

1) 432 mc transmit and 442 mc receive?

2) 2 meter transmit and 432 receive with lunar transmitter on 432 mc?

3) 1296 mc transmit and 1350 mc receive?

4) Any other combination of the above or . . . ?

Other factors also require discussion—Thermostatics; Telemetry; Antennas, (dictated by operating frequencies); Transmitters, receiver, identifier, keyer, sequencer packages, etc.

You can help design and build MOONRAY from anywhere in the world by:

1) Offering solid, technically sound suggestions on the design questions.

2) Offering to design, develop and/or construct any part of the MOONRAY hardware to the specifications decided on after we have reached a final design decision as the result of your suggestions.

3) Passing along the above information to fellow hams—or any other technical people—who might help get Moonray on the moon.

Write today to: Nastar, P.O. Box T, Syosset, L.I., New York 11791.

Remember, MOONRAY needs your help! ■

* Nastar—Nassau College Amateur Satellite Tracking—Headquarters located on Campus at Nassau College, Garden City, New York.



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DESIGNING AND BUILDING A FIVE BAND INDOOR ANTENNA

BY HARRY LOWENSTEIN, *W2HWH

I HAVE no idea how many hams are operating from apartments rather than two acre antenna farms. There must be quite a few, considering the "shortened antenna" articles I have been reading. The problem was not simple. I wanted to get out reasonably well, the landlord had a firm "no wires-no antenna" policy and any indoor antenna had to go along with the XYL's decor.

For a year I have been experimenting with various forms of restricted space antennas with varying results. The mobile center loaded whip is unsightly in a room and is difficult to mount with its coax fitting at the base. It was very hard to tune and feed (probably because of no automobile capacitance to ground).

The long wire wound around the room, and a dipole up and around the furniture worked but on three bands got the rig so hot, I would get lip burns from a grounded mike.

A commercial inside center-loaded antenna system designed to be series fed could

not be made to match to my rig's 52 ohm output without extra antenna tank circuitry.

Solution

Here is one solution. It is cheap, it really works all bands, and loads like mad. It cannot be compared to a high dipole or a beam but it gets out.

The antenna is made from a brass plated floor to ceiling support post originally designed to hold room dividers, lamps, *etc.* It comes equipped with plastic cups top and bottom to prevent marring the ceiling or floor. The bottom section has a spring-loaded rod to hold the assembly firmly to the ceiling. The three sections telescope-fasten together much like TV masting.

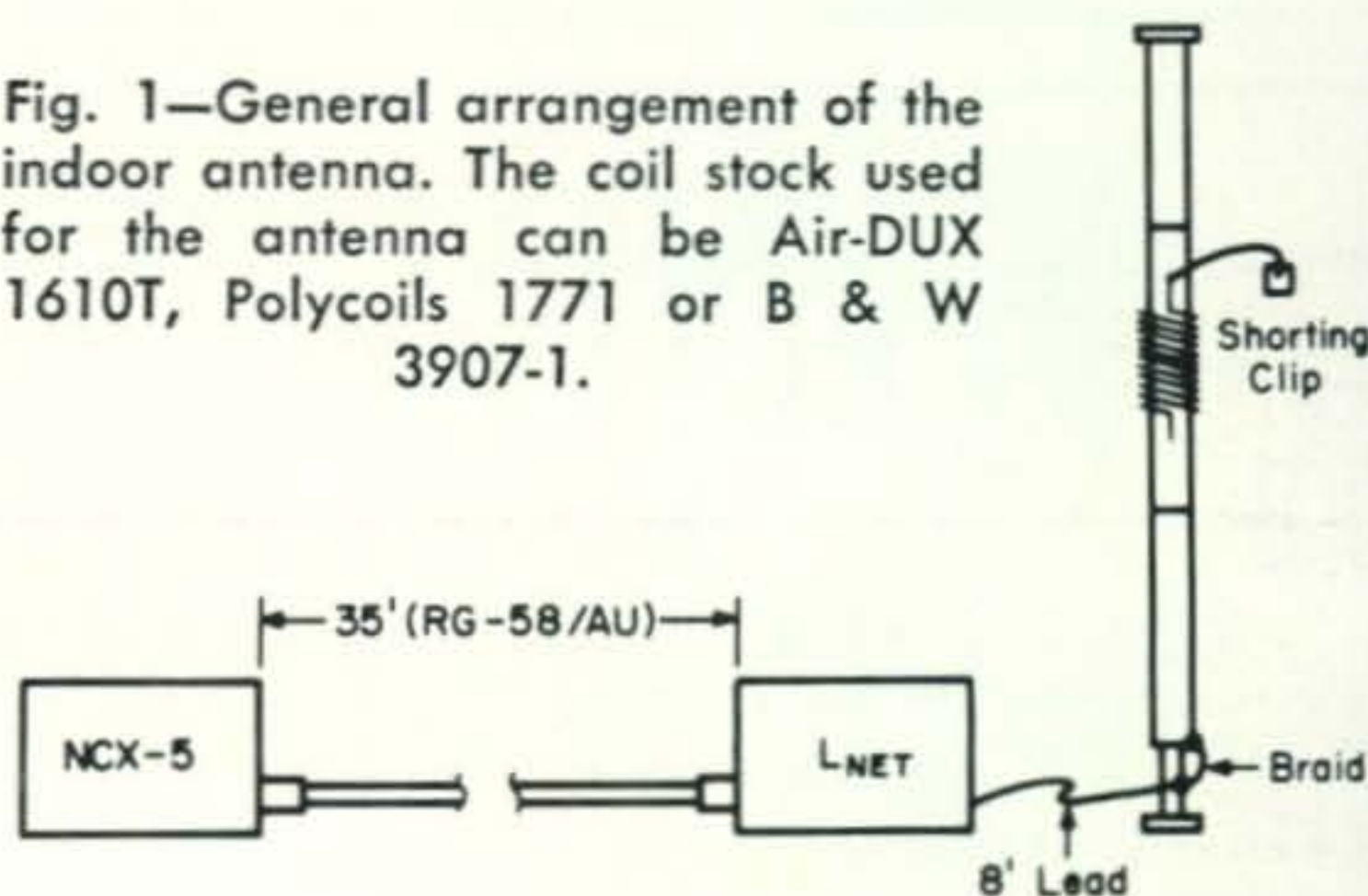
Construction

Hacksaw a 7" piece out of the center section of the post to separate the antenna for the loading coil. An insulating section has to replace this 7" length. The plastic insulation used started life as closet rod covering and is available in various colors. Cut it into 10" lengths and slip one over the other on top of the cut out section. Use DuPont cement between the plastic layers. Four layers did the trick but one or two more



Front view of the L-net using the ARC-5 coil and a 250 mmf tuning capacitor. The s.w.r. bridge is built into the lower section of the L-net chassis.

Fig. 1—General arrangement of the indoor antenna. The coil stock used for the antenna can be Air-DUX 1610T, Polycoils 1771 or B & W 3907-1.



could be used if you like. Don't skimp on the layers of insulation since there is quite a bit of pressure from the spring loaded rod that holds the antenna tightly between the floor and ceiling. Drill and fasten the plastic to the metal rod using sheet metal screws.

A 4½" length of 2" diameter 10 t.p.i. coil stock with 6" lead lengths is cut from the 10" length. It is then slipped over the plastic insulation and one lead of the coil is fastened to a sheet metal screw on the top section and the other lead is fastened to a sheet metal screw on the bottom section.

If you are a purist you may want to bound the individual slip fit sections with sheet metal screws but I didn't find it necessary. (It *must* be done if you use a *painted* pole.) It is necessary, however, to bond the telescoping spring loaded rod to the bottom section using some braid from a length of RG-58 and some sheet metal screws.

Feeding

The antenna is fed from an L-network as shown in fig. 1. During the experimental period it was found that feeding the antenna in this manner provided a broad frequency range. An s.w.r. bridge built into the L-network cabinet aids in tuning.

The network consists of a 250 mmf tuning capacitor and an ARC-5 adjustable coil (2" dia. 8 t.p.i. with a total of about 30 turns). If no ARC-5 tuner is available the balance of the coil stock used for the antenna center loading coil can be employed. The L-network arrangement for each band, along with the proper tap on the antenna loading coil, is shown in fig. 2. An 8' wire lead connects the antenna to the network. The coax feedline is exactly 35' long and the excess is coiled up under the furniture. When I used a 20' length reduced signal levels were observed.

I am using the hot water heating pipes for a ground but a 30' counterpoise wire dropped out the window worked just as well (if you can drop a wire out of the window). The ground lead from the L-network to the pipe ground point is 20' long.

Operation

The NCX was tuned up into a dummy load in the TUNE position. It was then switched to the c.w. position and carrier inserted for a 5 or 6 watt output, just enough to provide a reading on the s.w.r. bridge. The L-network and antenna coil are then

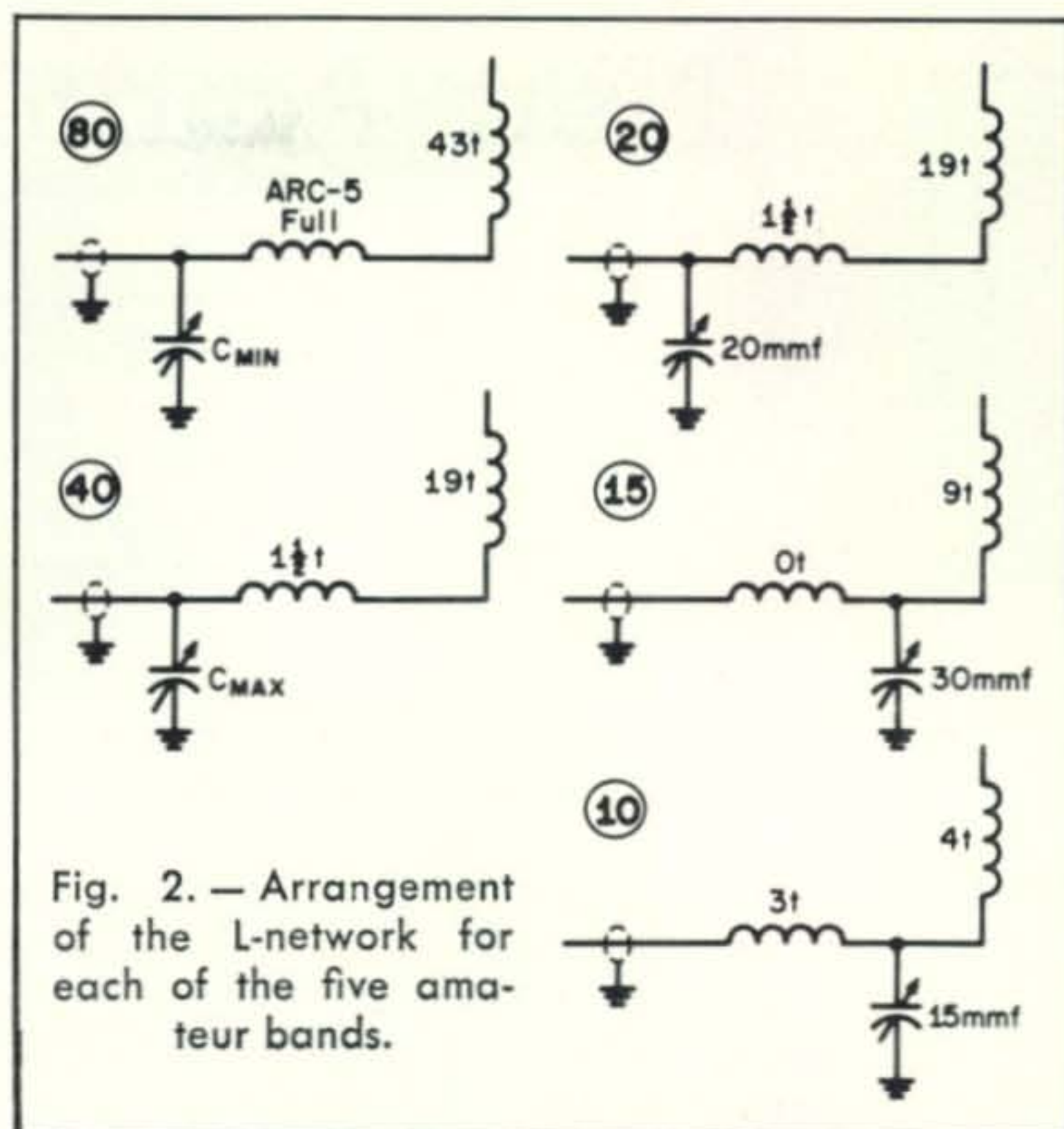


Fig. 2. — Arrangement of the L-network for each of the five amateur bands.

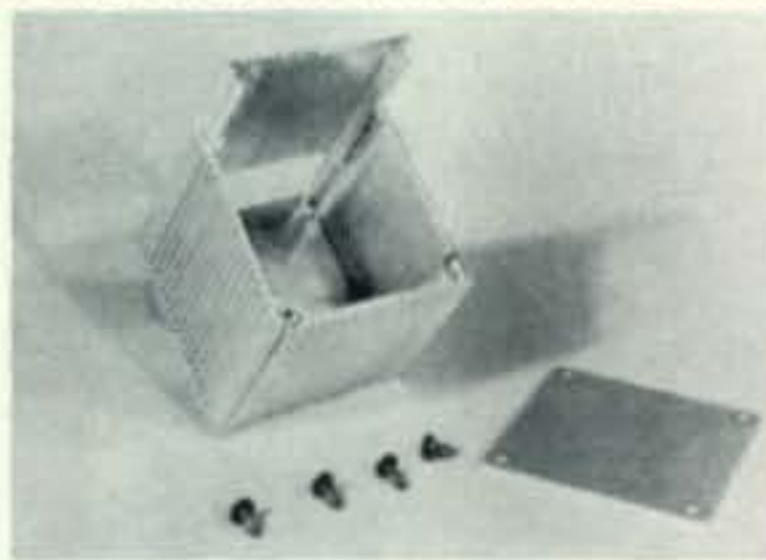
tuned for minimum s.w.r.

I spent a week adjusting coils and taps using the s.w.r. bridge and a diode field strength meter to produce some terrific results. The same settings will not necessarily work as well in other locations and some experimenting should be done. The results will amaze you. ■



View of the center of the antenna shows the loading coil and the shorting clip. The antenna is usually turned to the wall so that the clip doesn't show.

New Amateur Products



Sarex

Sarex announces a new integrated heat sink and enclosure in one stock unit. The unit slides apart into 6 flat parts for drilling, test and service of circuitry and easy assemble of components. For complete specs write Sarex Corp., 1001 Roosevelt Ave., Carteret, N.J. 07008 or circle 70 on page 120.



Salch

Door or floor mats are available with your name and call letters imprinted on the face. Mats are 18" x 28" and are available in various colors. For more details write Herbert Salch, Woodsboro, MPR, Tex. 78393 or circle 71 on page 120.



B & W

B & W have announced their model 381B electronic antenna changeover switch for 52-75 ohm coax line. Complete data is available from Barker & Williamson, Bristol, Pa., or by circling 72 on page 120.



Meredith

A new tool from the M. Separator Co. is known as the Bonding Pen. It is a handy, pocket dispenser containing an industrial bonding glue that is guaranteed clogproof and leakproof. For more information write Meredith Separator Co., 76 Greenhut St., Cleveland, Mo. 64734 or circle 73 on page 120.

Prosser

A portable alternator, Model 2511A, delivers 2500 watts at 115 v. The unit has an automatic transmission. Dimensions of the unit are 17" x 17" x 8". Additional info is available by writing Prosser Industries, 900 E. Ball Rd., Anaheim, Calif. or circle 74 on page 120.



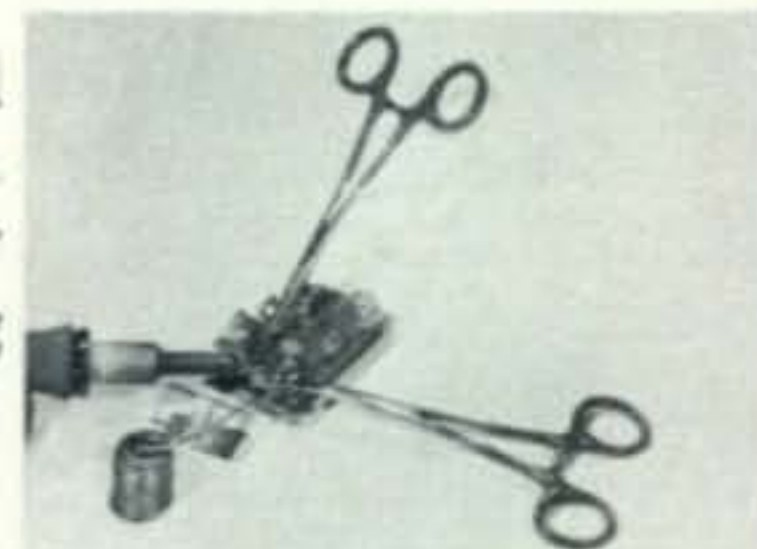
Clegg

Introduction of the new Classic series of v.h.f. converters was recently made by Clegg. These customized units are available from stock at leading dealers. Two of the newest additions are the Cruiser 6 and Cruiser 2. For full details on the complete line, write Clegg Associates, Box 376, Morris Plains, N.J. 07950 or circle 75 on page 120.



Allis

New stainless steel seizer/pliers from Allis is ideally suited for holding and retrieving small components. It features a locking device for clamping. Descriptive bulletin and quantity price list upon request from Allis Industries, 143 W. 41st St., New York, N.Y. or circle 76 on page 120.



Heuer

Simultaneous time-of-day readings for any 2 Greenwich-based zones can be obtained with the Autavia GMT — developed by Heuer-Leonidas S.A., introduced by Feldmar Watch Co. Further information is available from the Feldmar Watch Co., 9002 W. Pico Blvd., Los Angeles, Calif. 90035 or circle 77 on page 120.



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Grumbles

by Sam



CHRISTMAS means more than just Jingle Bells to anyone interested in radio, it means many coins jingling in the pockets of people selling walkie-talkies. Walkie-talkies have really made it big—they're sold over the counters at drug stores, toy shops, TV repair emporiums, department stores, dime stores, and even at places selling ham and CB gear.

The big season, of course, is Christmas since the best way to get little Waldo off the street corners is by buying him a walkie-talkie so he can press a button and make like Space Patrol. Equipped with his tiny communications station, he stands on the same street corner and creates TVI, jams CB communications, says "10-4" and all kinds of weird things, making a general pain in the antenna of himself. Eventually the batteries wear out and, lacking the interest and ability to do so, the set is discarded and the whip antenna is made into a beautiful chrome-barreled zip gun.

I'm not disputing the fact that it would probably be a great emotional relief to get your fingers tightly wound around the scrawny necks of a few of these beggars, but I also wonder why ham operators haven't realized that each adenoidal voice screaming "10-4" into a \$3 walkie-talkie might just possibly be a potentially *good* member of the fraternity. Really!

Problem is that these kids had the communications bit thrust upon them by the giver of the walkie-talkie, they didn't have any *need* for the thing and suddenly it was there. Lacking anything specific to do with it, they found no better use for it than to revert to the basic code of the human jungle; which

says, "if you can't be anything else, you can at least be annoying."

You, sitting there with your 5 kw Super Chrome-Plated Frammis Mark II linear and the 55-tube kilocycle inhaler, are easily thrust into the role of being judge and jury in condemning these hapless creatures—you took an FCC exam and spent 5 times the amount you could afford in order to be the largest noise this side of 200 meters. Here comes this snotty creep with his \$3 electrified cigar box with the fishing pole on top and makes like The Voice of America.

Maybe, as a member of the ham fraternity, you could do more than fill the ether with sidebands. Possibly you could take a few of these kids gently into your shack and dazzle them with 15 minutes of ham radio. The equipment will impress them and if you should offer them the treat of actually working someone on the thing you might well fertilize the seed of interest in radio already implanted by the walkie-talkie.

Don't think it will work? Of course it will. Take a listen on 75 tonight—the amount of fertilizer is appalling!

By the way, I enjoy receiving mail from readers of this little section; even if the mail rakes me over the coals for something I've said. I always get mail from my 8 regular readers and possibly 2 or 3 itinerants who happen to stumble across the page by accident. A few months back we carried some lines about the absurdity of most of the bland conversations heard on the ham bands and the mail count rose to a fantastic 14 letters so we knew that we had really rung the bell. As a result I am at present preparing some

[Continued on page 108]



QUAD

BY WILLIAM E. LAFARRA,* W5ZCC

This 10 and 15 meter quad is simply constructed using easily available materials. It is an excellent performer sturdily built, inexpensive and should do well for the blossoming 10 meter band.

IF ANYONE has tuned across ten meters the past few months, they would know the sleeping giant is slowly awakening. Anyone having experienced the peak sunspot activity of this band will find it hard to keep away. Not having a ten meter antenna it was only natural for our thoughts to turn in this direction. I am a beam enthusiast and this was my first thought. However, many hams were on the air with quads and the magazine ads were full of commercial jobs. We felt that it would be a good time to try our hand constructing a quad since we had built several beams. We

had little or no knowledge of the quad and could not find much good information available. Armed with what we had, we decided to fabricate something that would fit our needs.

It seems such a waste to design a quad for one band. Once the mechanical structure is complete adding other bands is a small problem; however, one for 20 meters does get rather large. Not being interested in 20 meters we settled for 10 and 15 meters. Our 15 meter beam¹ was doing well, and

¹LaFarra, W. E., "Constructing An Inexpensive 15 Meter Beam," CQ, July 1960, p. 40.

*P.O.B. 43, McGehee, Arkansas.

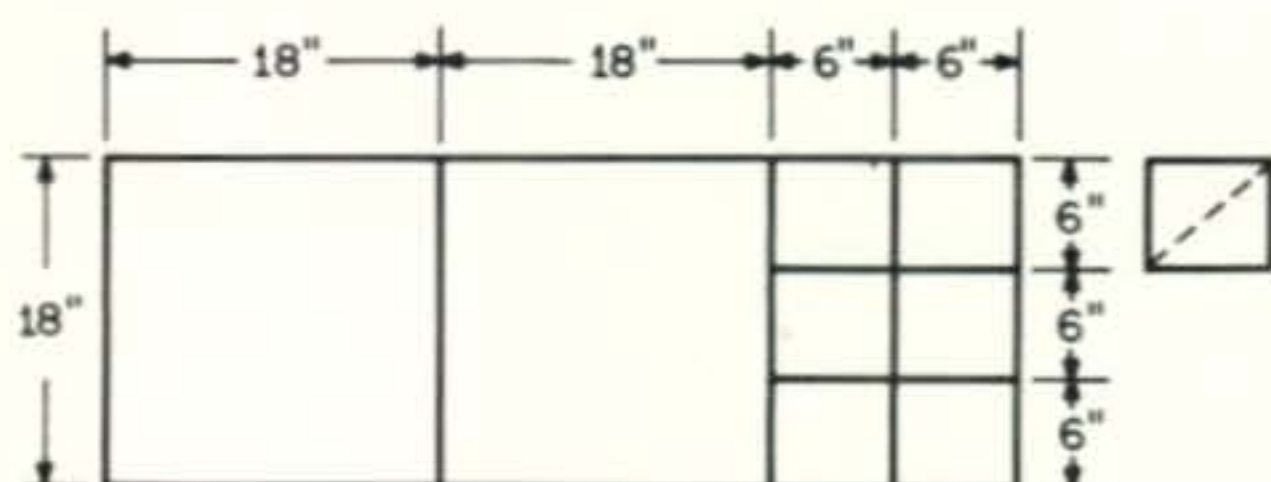


Fig. 1—The 18" × 48" × 3/8" plywood board is cut into the two boom ends 18" × 18" and the remainder of the board provides the eight triangular boards for reinforcing as shown in the photographs. One of the remaining plywood sections is used to reinforce the boom-mast junction as shown in fig. 5.

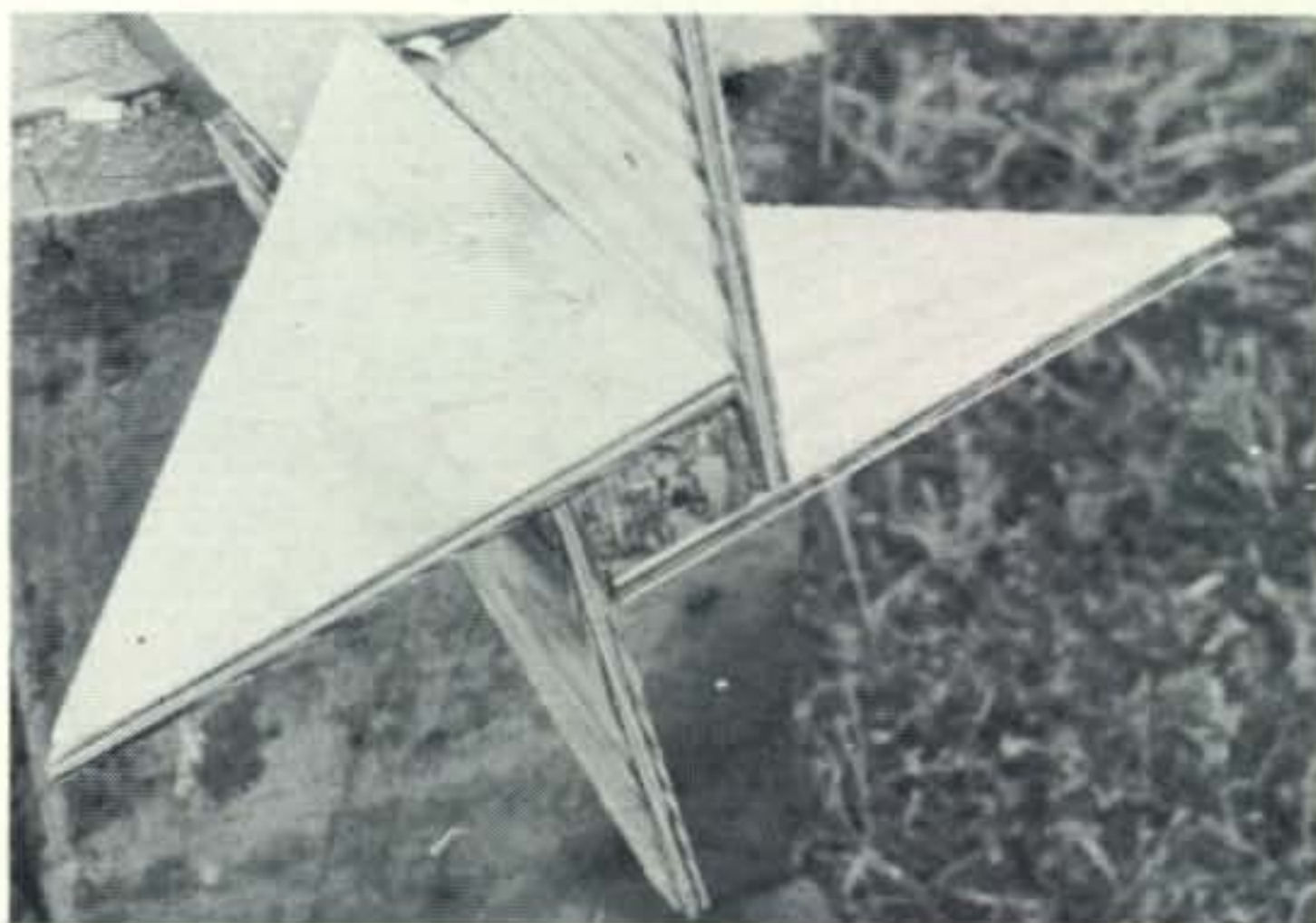


Fig. 2—View of boom end showing how triangular pieces are placed to reinforce the endplate.

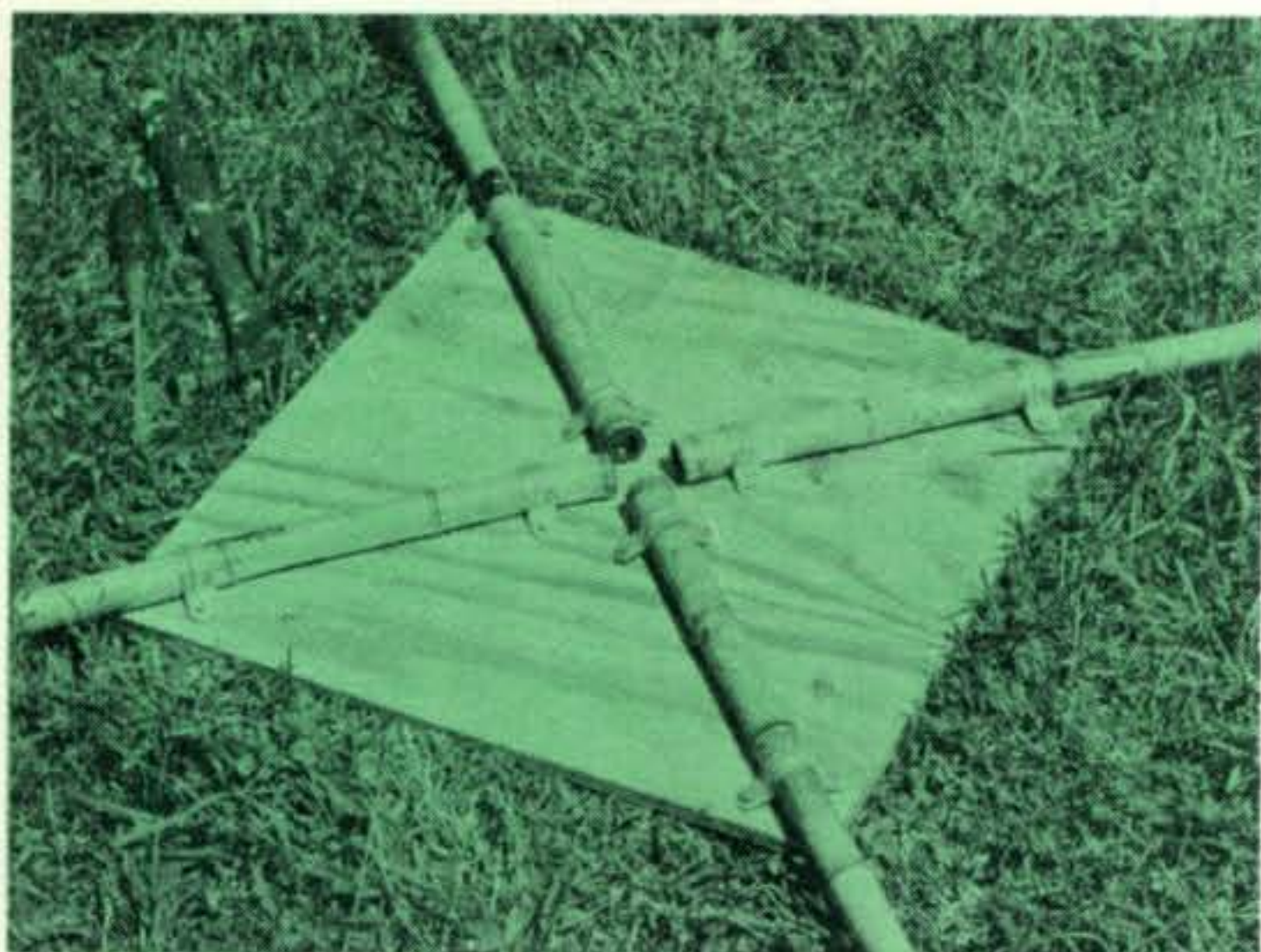


Fig. 3—The bamboo cane poles are mounted on the 18" × 18" plywood end plates using 3/4" conduit clamps.

this would give us an opportunity to work the beam and quad against each other under practically the same conditions. Switching back and forth between the two would allow us to form our own opinion as many fallacies have been circulated for both.

For material I decided to try all wood construction even though we felt that weather and elements would be against it. Surely it would last 6 years which should carry us through this sunspot cycle. We went to the local sporting goods store and examined the 12-15 foot fishing poles for 50¢ or \$1.00, depending on how good a pole you wanted. What we needed was a pole relatively straight and strong for a 9 foot length. Most of the poles we purchased were 13, 14 or 15 feet long, and we bought nine to have an extra in case of an accident. Ducking questions to what I had in mind, I managed to purchase all nine for \$4.00 cash. Next stop was the local lumber yard

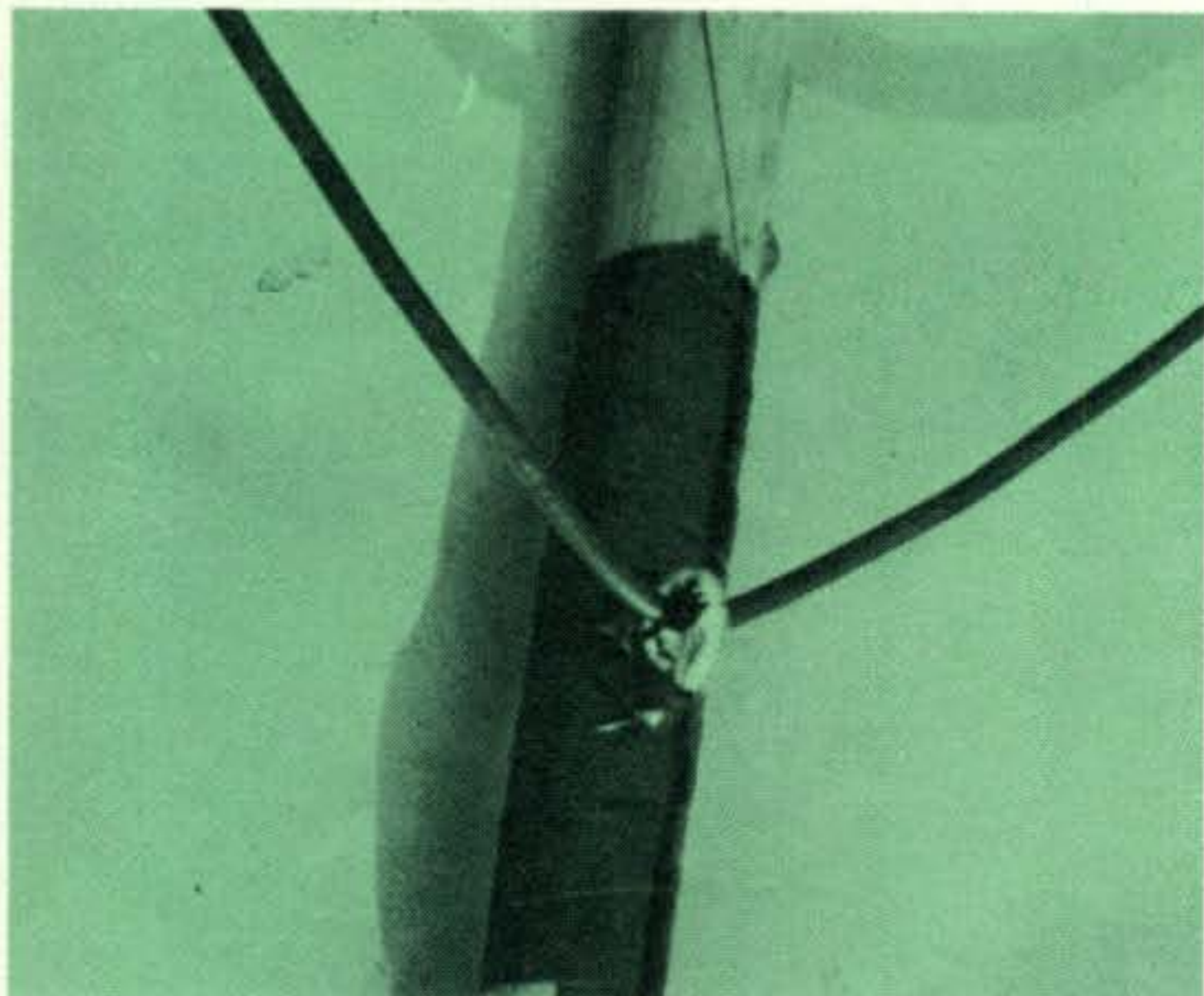


Fig. 4—Hook eyes are screwed into the bamboo pole and taped to help keep out moisture.

for two lengths of 2" × 2" and two lengths of 1" × 2", all 8 feet long; also a piece of 3/8" plywood 4' × 18", a box of 1" #9 wood screws, 16 screen door hook eyes, and 1/2 gallon of vinyl plastic paint.

Construction

Once all the wood material was cut to specifications (see fig. 1) it was placed in a location that would not be disturbed and at every opportunity a coat of plastic paint was applied. Outdoor latex house paint ought to do well also. After several coats had been applied, the boom and upright support was assembled. The small triangle sections were fastened to the boom ends as shown in fig. 2. The 18" square plywood pieces were laid out flat, and the cane poles, cut to 9' lengths, were fastened using 3/4 inch conduit clamps (fig. 3).

Mark the positions for each of the hook-eyes on the bamboo poles and screw them in. For 15 meters they will be 8' from the center of the plywood board and 6' 2" for 10 meters. After screwing in the eyes wrap the pole with tape (fig. 4) to keep out moisture.

Element Length

The length of each element is determined by the formula:

$$L = \frac{250}{f_{mc}}$$

For 21.3 mc the length will be 46' 11" or 11' 8 3/4" on each side.

For 28.6 mc the element length will be 34' 11" or 8' 8 3/4" per side.

Assembly

The end plates with the cane poles are secured to the boom ends. Standing the boom on one end and using a step ladder will

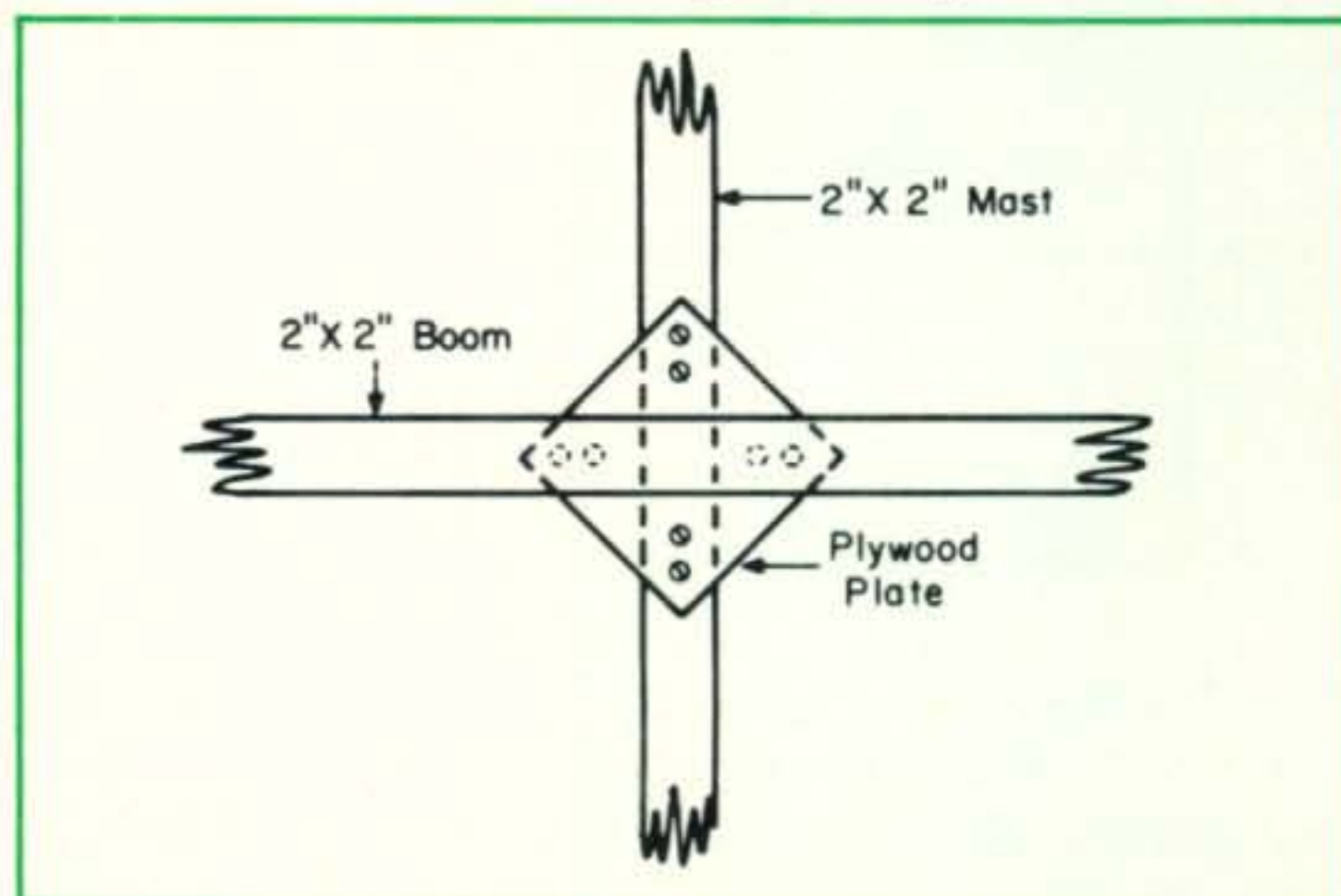


Fig. 5—A piece of 3/8" plywood is placed, as shown above, between the boom and the mast to reinforce the joint.

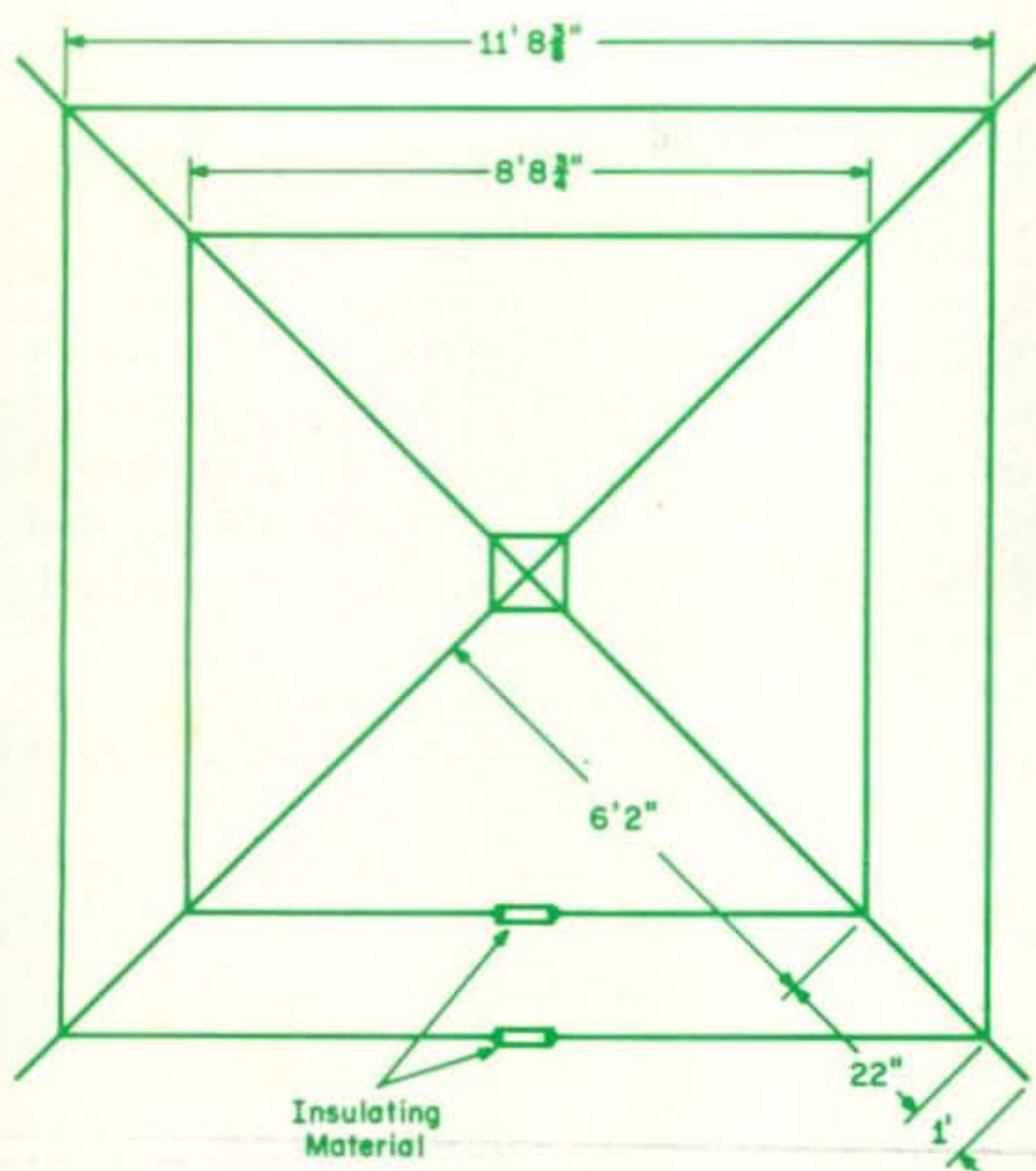


Fig. 6—End view and dimensions of the driven elements or rector. The ends are terminated on the 1" $\times$ 2" lengths secured to the 2" $\times$ 2" upright. The driven element is fed through baluns (shown in fig. 8) and the reflectors are tuned with stub as shown in fig. 7.

simplify this little chore. With a helping hand from the XYL (W5BHA) the same procedure was repeated for the other side.

The boom was mounted to the upright support, the second 8' length of 2 $\times$ 2, using a plywood plate for reinforcement as shown in fig. 5.

Secure the two 8' lengths of 1" $\times$ 2" as shown in the accompanying photographs, one at the proper level to tie up the 10 meter ends and the other for the 15 meter ends. String the driven elements as shown in fig. 6. Leave several feet on each end in the event it is necessary to adjust the length when tuning the elements later.

Stubs

The tuning stubs for each of the reflectors

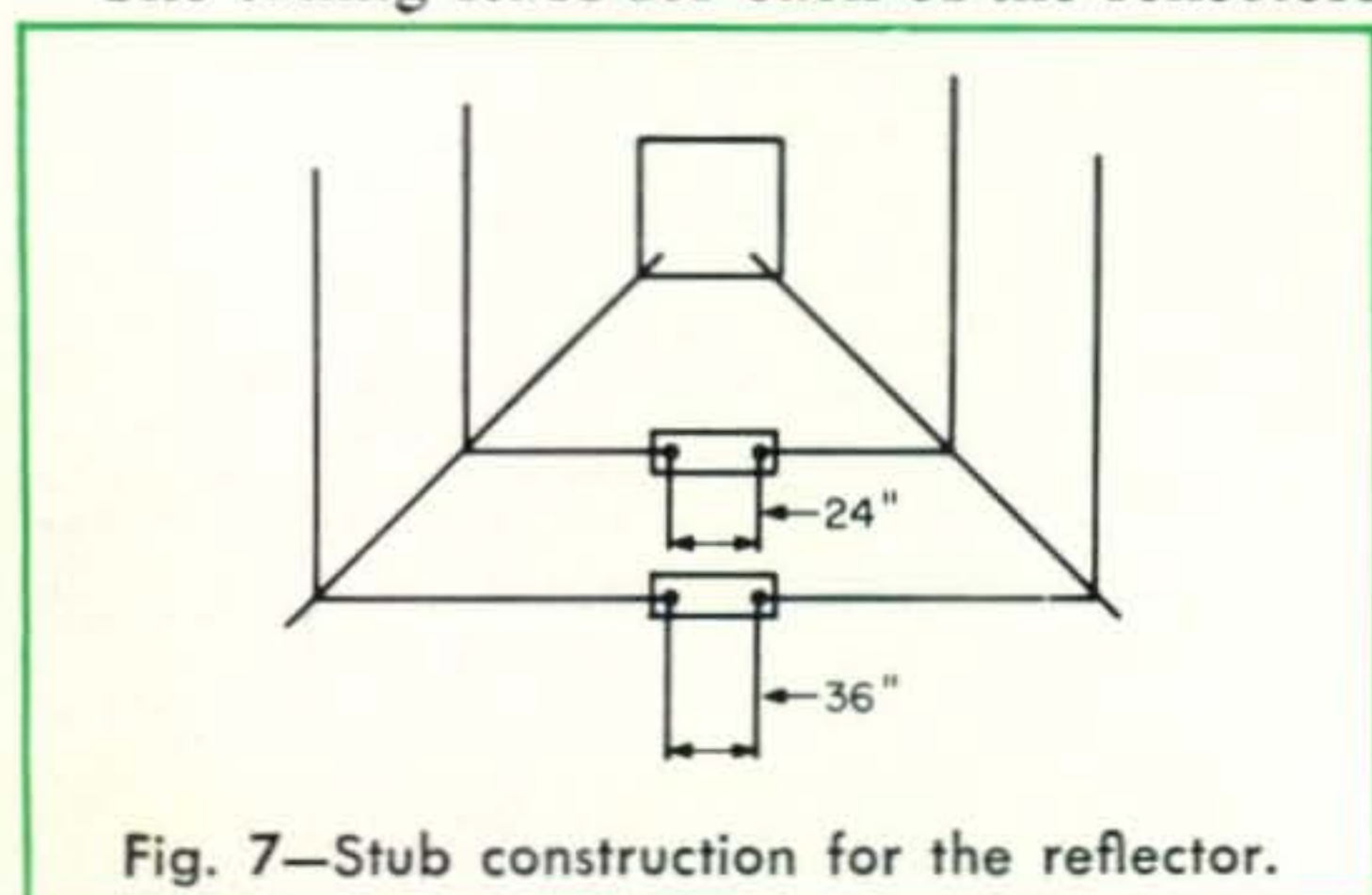


Fig. 7—Stub construction for the reflector.

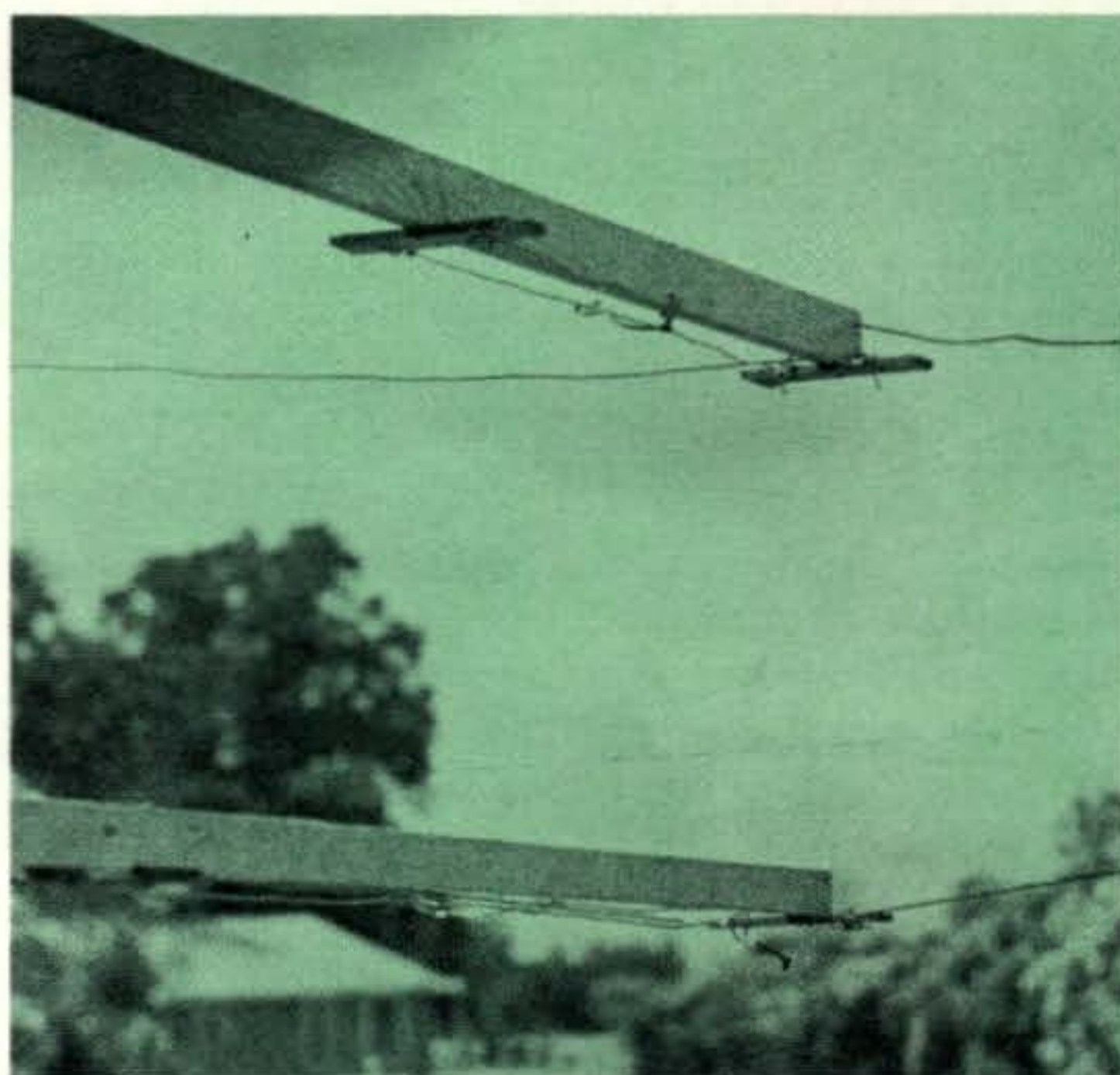
was constructed by mounting 3" blocks of insulating material at the end of both the 1" $\times$ 2" lengths. On the 15 meter reflector 1" $\times$ 2", the insulators are spaced 3' and for the 10 meter 1" $\times$ 2", the insulators can be spaced 2' apart. The reflector elements are extended, using #14 wire, as shown in fig. 7 and the photographs. Using a length of wire, short out the stub about 2' back on the 15 meters stub and 1' back on the 10 meter stub.

Tuning

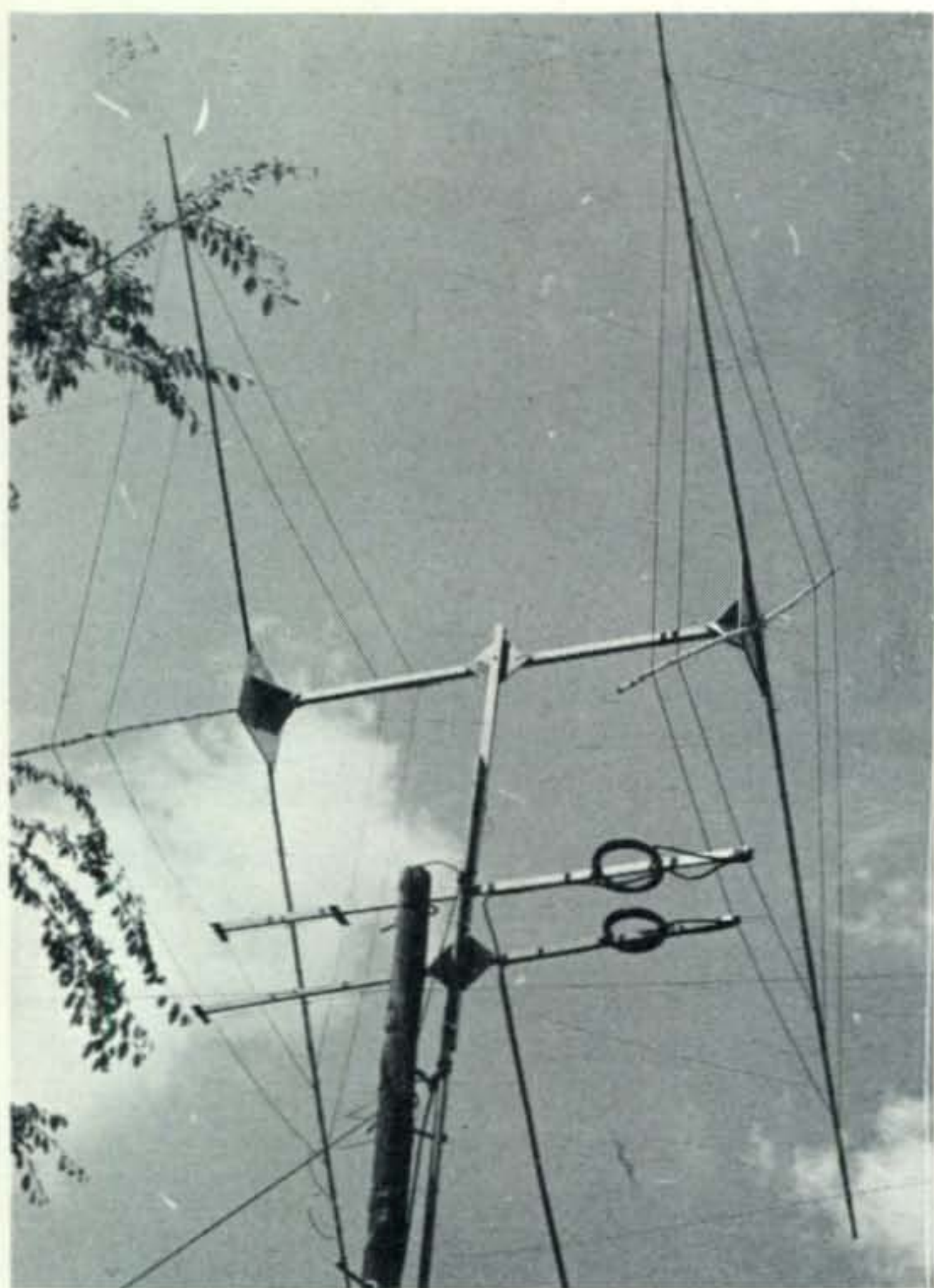
The unit is now ready to be mounted in a location where the bottom wires and stubs can be reached from a step ladder for further manipulation and tuning.

When tuning the antenna the correct starting point is to grid dip the driven elements to the desired frequency. This is done by coupling the g.d.o. to a short placed across the driven element and dipping the meter. The g.d.o. frequency should be checked against the station receiver to insure accuracy. If the frequency is higher than desired, lengthen the element. If the frequency is lower shorten the wire but only a few inches at a time. By relocating the screw eyes the slack can be taken up without putting the antenna too far out of square.

To tune the reflector elements a field strength meter is needed. Some grid dip meters can be used in this manner. If no f.s. meter is available a temporary dipole and rectifier, such as shown in fig. 9, should be made. If the rectifier circuit is placed directly across the insulator any type of cable



Close-up view of the tuning stubs on the rear of the 1" $\times$ 2" supports.



A worm's eye view of the 10-15 meter quad shows the general construction of the mast, boom and end plates. Also seen are the 1" $\times$ 2" supports with the baluns neatly coiled at the end and the two coax feedlines. The insulators can be seen on the reflector ends of the 1" $\times$ 2" booms. Close-up view of the baluns mounted on the 1" $\times$ 2" supports.

can be used between the meter and rectifier circuit. Zip cord or twisted pair will work as well as 300 ohm ribbon line or coax.

Place the dipole some distance behind the quad and extend the cable so that the meter is close to the base of the antenna. By doing this you will be able to adjust the stub length and see the effect upon the signal radiated from the back of the antenna.

Feed the antenna with a low powered signal at the desired frequency and shift the short across the stub. When the correct point is reached the meter will register a sharp dip. If a dip cannot be found it is because the reflector element is too long or too short and it will have to be adjusted until a dip can be found along the length of the stub.

Both the 10 and 15 meter reflectors are adjusted in this manner, for best front to back ratio. The short would appear in the same place if the reflectors were adjusted for maximum forward gain (with the tuning dipole in front of the antenna) but the ad-

justment is so broad that the peak is difficult to find.

Baluns

Once the antenna is tuned the impedances at the feed points can be measured with an Antennascope² if desired. With an 8' boom we have 0.17 wavelength spacing on 15 meters and 0.23 wavelength spacing on 10 meters. Most quads have closer spacing and lower impedances. With 0.1 wavelength spacing the input impedance is close to 70 ohms and 0.25 wavelengths will produce a somewhat higher impedance with the gain remaining the same for either spacing.

With narrow spacing the driven element could be fed directly with 52 or 72 ohm coax and achieve a good or reasonable impedance match. The quad, however, is a balanced antenna and should not be fed directly with coax, which is unbalanced, but rather through a balun. This helps to maintain a correct radiation pattern.

The use of 8' spacing between the elements raised the impedance of the driven elements so that for 10 meters we measured 160 ohms and for 15 meters, 140 ohms. A balun of the type shown in fig. 8 offers a 4:1 impedance transformation as well as balanced to unbalanced matching and so for 10 meters the coax feed sees 40 ohms and on 15 meters 35 ohms. With 52 ohm coax this provides an s.w.r. of 1.3:1 and 1.48:1, respectively. As the quad is a broad band type of antenna the s.w.f. holds through the band.

The balun lengths are determined from the formula:

²Scherer, W. M., "Antennascope-54," *CQ*, Part I June 1954, p. 23, Part II, July p. 17.

Geisser, D. T., "The Instrument Deluxe," *CQ*, October 1962, p. 47.

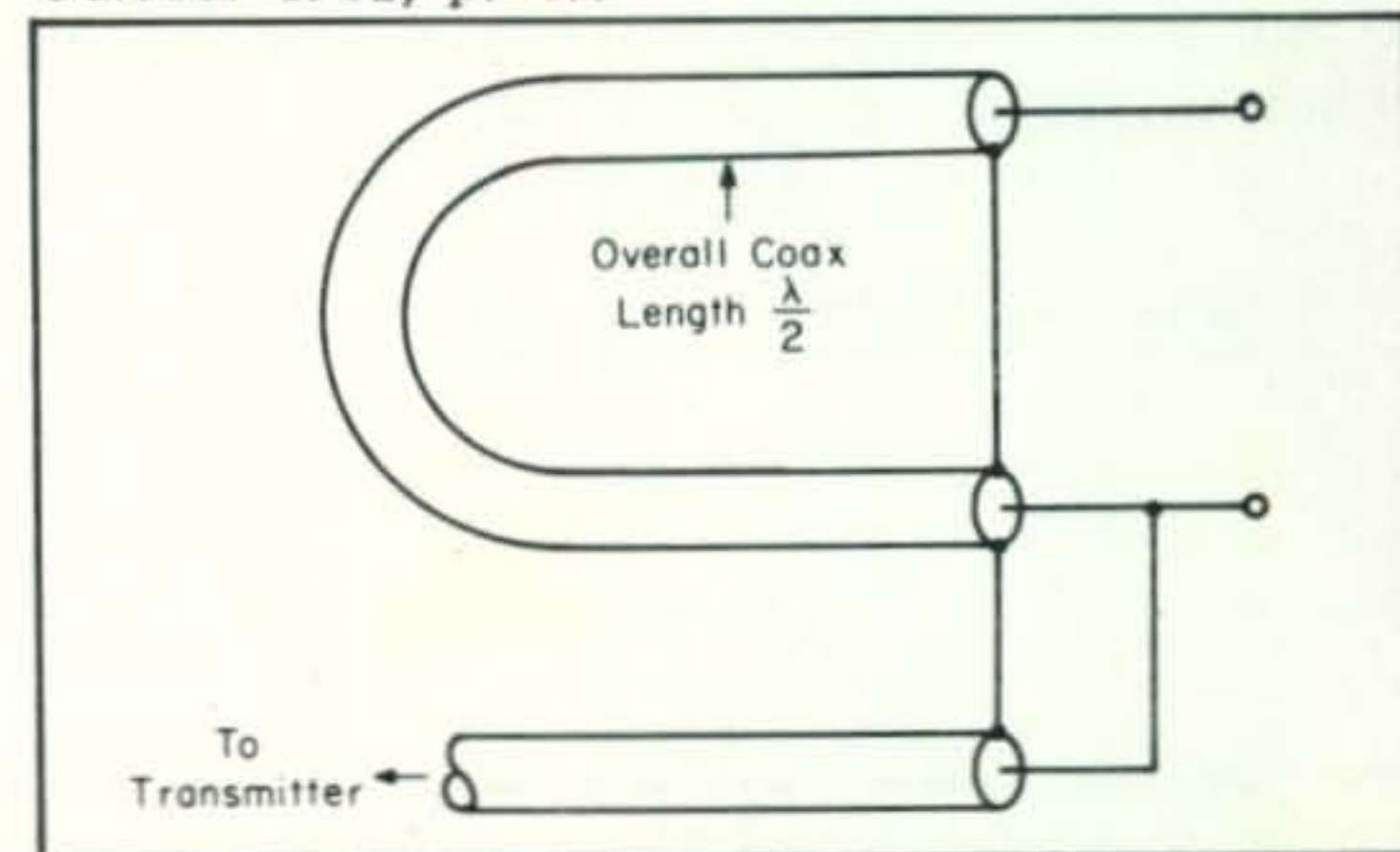


Fig. 8—Coax balun used to feed the symmetrical quad driven elements provides a 4:1 impedance transformation as well as a balanced to unbalanced match. The baluns should be $\frac{1}{2}$ wavelength long for each operating frequency.

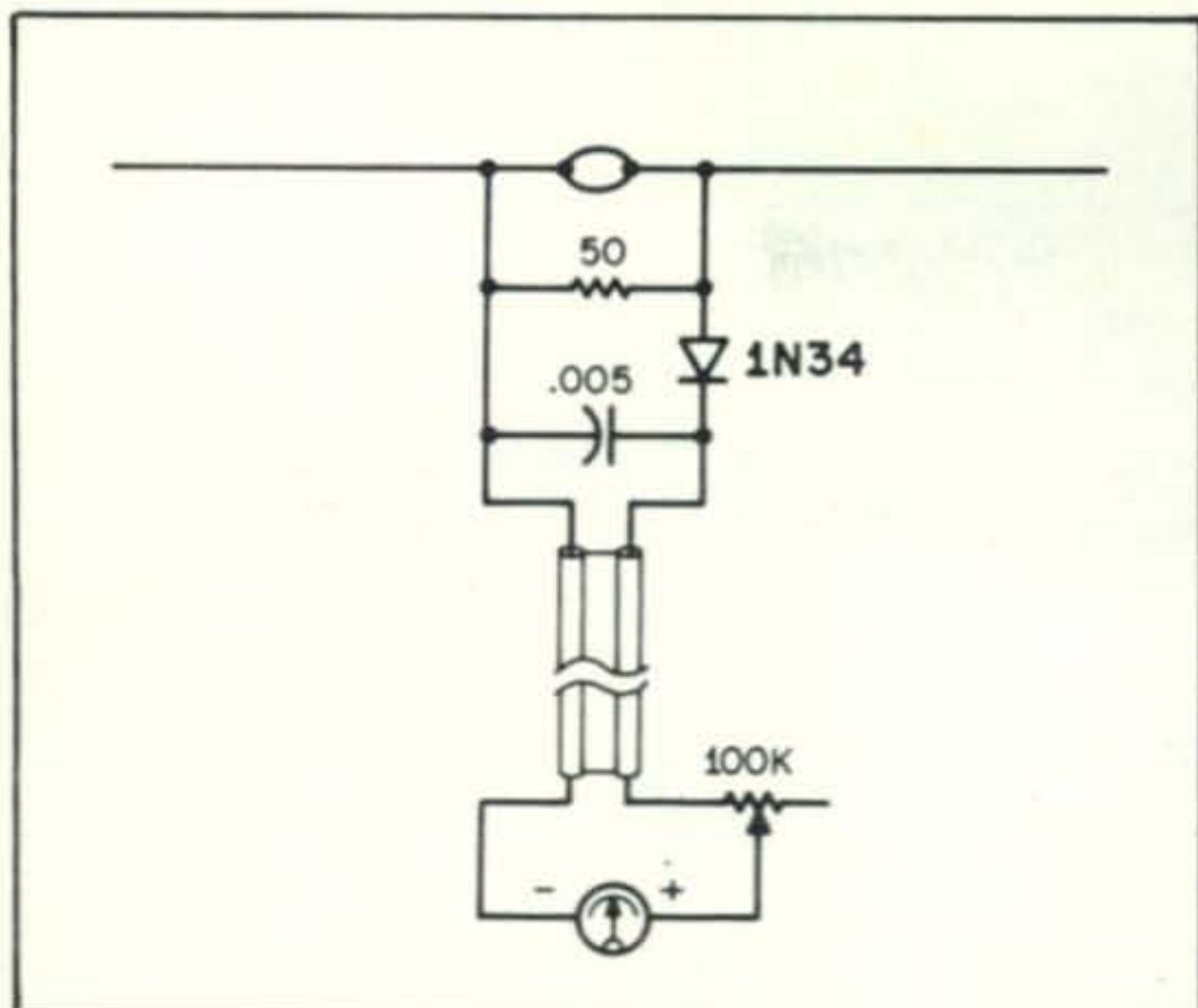


Fig. 9—Set up of a temporary dipole for tuning the reflectors. If the rectifiers and components are placed at the antenna insulator the connecting cable can be zip cord or any other type of wire. The meter should have a range of 0-50 or 0-100 microamperes.

$$L = \frac{340.8}{F_{mc}}$$

For the frequencies used the 15 meter length will be 16' and the ten meter length 12'. The sections should be coiled and mounted on their respective 1" x 2" supports. When constructing the baluns be sure that the outer braids are securely connected to each other and that the open ends of the coaxial cable are taped to make them impervious to water.

Results

After tuning the quad was hoisted to its permanent mounting. As for the results we can only say it was fantastic. Our first contact was VK3BW when the 10 meter band was virtually dead. CX8DV called in and gave us 10 over 9 in Uruguay.

On 15 meters our first contact was with F5RV, Rudy, in Nice, France, who gave us 5-7 to 8. We then contacted G3PIC, Jim, near South Hampton who also gave us an S 8 and a good comparison with the 3 element beam located at practically the same height. Jim reported 1½ S units difference in signal strength and so it was, down the log; the quad ran about one S unit better. All reports were gotten running the S line barefooted.

While testing my quad the weather decided to try it out too. It withstood two spring storms of tornadic winds which uprooted 55-year-old oak trees and knocked down power lines in this vicinity. This gave us a chance to vouch for its strength and stability. ■

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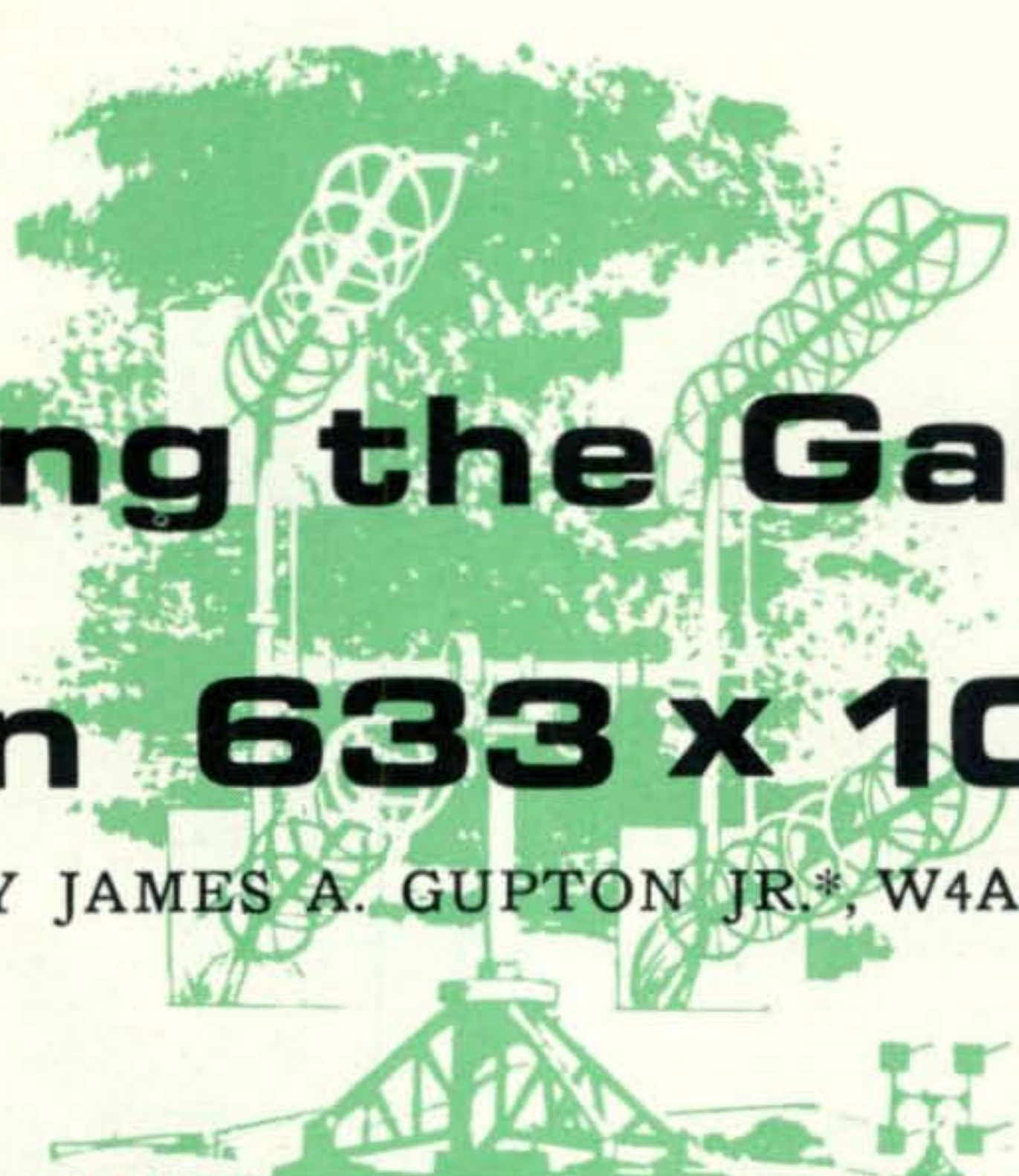
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BY JAMES A. GUPTON JR.*, W4AML

Here is a semi-fictional glimpse into some new horizons in communications.

W^{4AML} off and clear and pulling the main switch" I droned into the microphone and disgustingly cut the power to the transmitter. Another evening of the now dull exchange of the amateur jargon of "CQ", "QSO", "QTH" and the never ending descriptions of equipment and comparison of signal strengths.

Fifteen years ago this had been the most exciting language in the world to me as I laboriously pounded out the five words per minute in Morse code. I recalled the excitement of my first radio contact as a Novice and how my chest filled with pride as I lovingly tuned my first hand built rig. It only had 75 watts input power, a mere squeak in the ether as compared to my latest two kilowatt p.e.p.'s roaring voice.

No longer did I have to hide the multitude of interconnected chassis in the workshop. I now have the den for my ham shack and the rig is neatly flush mounted in the paneled walls. You might say that my shack is like the typical "Dream Shack" of most amateurs and yet, I am bored stiff! The thrill and excitement are gone. I longed to try something new, to build something new, anything to get out of the dull routine I have fallen into.

After shutting down the "rig" for the night, I joined my wife, Edith, in the living

room to watch the "One Eyed Monster" called TV. "Did you see the new book that came today?" Edith asked. "No," I replied. "Where did you put it?" "On top of the book case," she responded, "just where I put all your books."

For the past five years I have received copies of the latest electronic text books from the publishers, for review and possible adoption into the curriculum at the Technical Education Center where I teach electronics. This book was not the ordinary text variety. Instead it was a current best seller entitled *Flying Saucers are Serious Business* by Frank Edwards.

Now like most men, the very mention of UFO's immediately activates my interest. Perhaps this is caused by recollections of my boyhood comic strip heros "Buck Rogers in the Twenty-Fifth Century" and "Flash Gordon." Both portrayed the heroic champion of earth in adventures in outer space. Whatever the reason, I am fascinated by stories dealing with space, whether fact or fiction.

As I began to read, haphazardly, I was intrigued with the impression that Edwards was stressing the theme of space communications. In one chapter he relates the experiments of Nikola Tesla in the early 1900's. Tesla, under Government contract, constructed giant "Tesla" coils in the hills of Colorado. By generating tremendous bolts of man-made lightning, he literally trans-

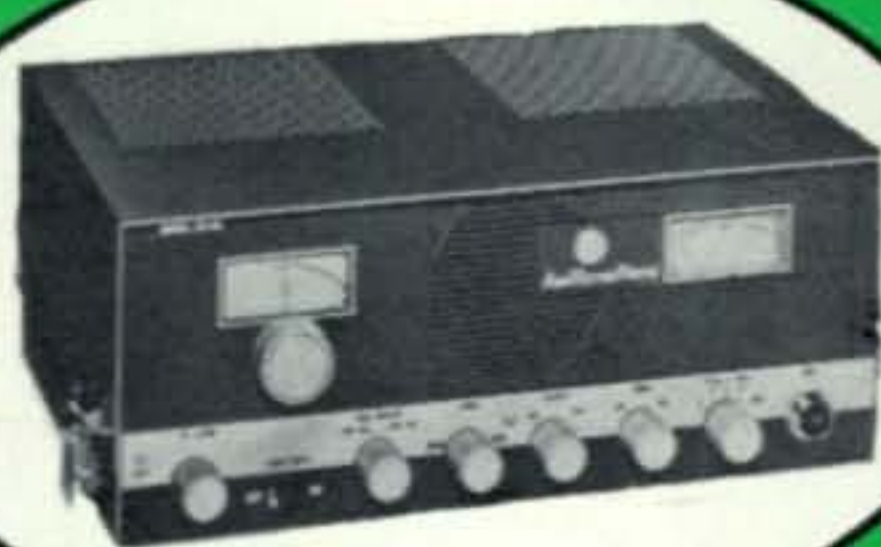
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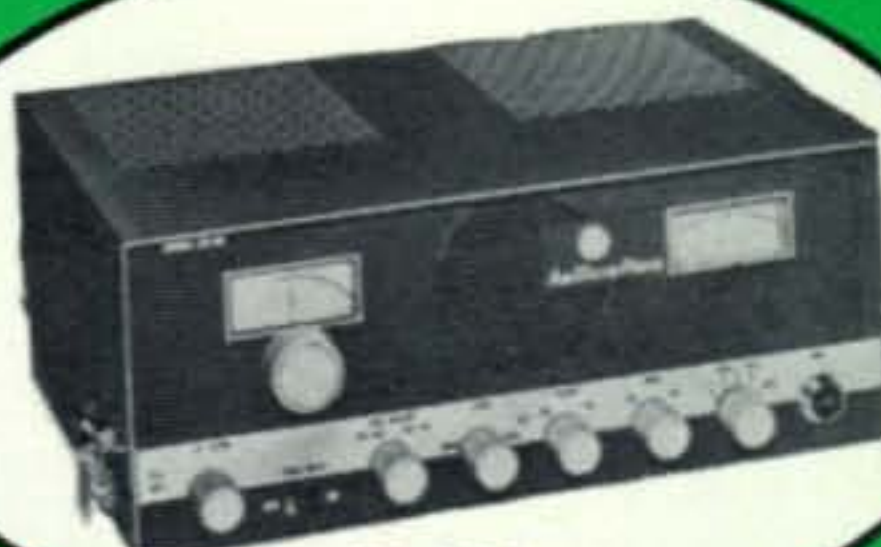
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mitted radio signals of the letter "V" into space at tremendous power.

In another chapter Edwards relates the historical Marconi transmission of the letter "S", the first wireless signal to be transmitted across the Atlantic Ocean. Edwards relates how exactly twenty-two years later coinciding with Tesla's experiments we received the letter "V" from outer space and a year later we received the letter "S" from space and on the anniversary of Marconi's transmission. He relates the strange reception, in England, of a Texas TV station, three years after the station went off the air. Still another chapter relates the operation of the giant radio telescopes and of the signals being received from star constellations more than 100 light years distant.

The theme of the book had formulated the idea to experiment in space communications. This idea is not new to amateur radio. Amateurs have sent high frequency signals to the moon and received the echo. Since they have consistently received the signals from space satellites, then, why not attempt reception from outer space?

After classes the next day, I made a customary visit to a local Research Plant, as all technical teachers are required to visit local industrial firms periodically as sort of a good will public relations service. There I looked up an old friend, Bill Van Steen, who is a Communications Research Engineer.

"Bill," I said, "I need your advice." "On what, Jim?" he replied. "As an engineer, what in your opinion would be the best method for communicating through space?" I asked. "Why, light, of course" he stated. "You're kidding me," I retorted. "Light, instead of radio waves?" "Of course," he laughed. "Like radio waves, light has similar sinusoidal characteristics but at much shorter wavelengths." "Wouldn't the shorter wavelengths limit transmission to the horizon?" I asked. "On earth, yes," Bill returned. "But in space there is no horizon."

"Come, let me show you what I am working on," invited Bill. With that, he led the way into the laboratory. "I have been working with Lasers for the past two years," informed Bill, "and the potentials are enormous for communications." "Laser!" I shuddered. "Why they can kill you." I recalled the scene from "Goldfinger" where James Bond was almost split in half with a Laser. "It's not that kind of a Laser," laughed Bill. "The one I work with is only

a five-milliwatt Continuous Wave Laser and it can't hurt you unless you happen to look directly into the beam."

After turning on the Laser, Bill adjusted several mirrors and placed what appeared to be a sheet of glass into the beam. "Look at this," he invited. "This is known as a Hologram." I timidly looked into the glass, mindful of Bill's warning about looking directly into the Laser beam. "My gosh" I exclaimed, "There's a miniature house suspended in the air". "It's a true three dimension photograph" Bill explained, "Move your point of view upward and you can see the top of the house, move your point of view downward and you can see under the house." "Now I've seen everything" I said in awe. "Not quite yet" Bill smiled, "Wait until I show you the glass that turns black in BLUE light and clears in RED light." "That, I gotta see" I chirped.

In the room next to the Laser various measurements dealing with light were being conducted. Huge 1600 watt Xenon light sources were beaming intense light onto a telescope-like object. "Here we are measuring the power of each frequency of light contained in the Xenon beam" Bill explained, "White light is composed of all frequencies from 3500 Angstroms to over 7000 Angstroms." "What is an Angstrom?" I asked. "You know what a meter is?" he replied. "Yes" I stated. "Well divide the meter by 10 and what do you have?" Bill asked. "Centimeters" I replied. "Now divide the Centimeter by 10" Bill invited. "Millimeters" I answered quickly. "Good" said Bill, "Now divide the millimeter by 1000". "One thousandth of a millimeter?" I asked, "What is that called?" "A micron" Bill replied, "and a micron divided by 1000 is called an Angstrom unit". "What is that in inches?" I asked. "As we would put it" Bill stated, " 3.937×10^{-9} or .000,000,003,937 inches". Bill had been acting as a teacher to me in defining the Angstrom unit, so, like many of my students, I thought I would try to trap him with a question. "Bill" I asked, "If the Angstrom unit is so small, how do you measure it?" Bill answered with a question, "How do you measure a radio frequency?" "Why with test equipment such as a Frequency Meter, Electronic Counter or an Oscilloscope." I replied. "Well" stated Bill, "We use a Monochrometer which is an adjustable narrow band light filter which passes only the frequency of light it is set

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for". "But that will give you just a single color or frequency of light" I replied. "Yes" Bill assured, "But feeding that single frequency of light into a sensitive photomultiplier tube and metering its current and we can record a pattern which peaks at the indicated frequency and falls off on each side of the peak just like a resonance pattern of a radio tuned circuit".

As the time was getting late and I had already occupied too much of Bill's valuable time, I suggested that he walk me to the front office. On the way I asked Bill "If light had ever been used for communications other than the sound optical recording used in the motion picture industry?" Bill replied, "We feel that by using the coherent light of the laser, it would be possible to carry approximately 83 million two way telephone conversations plus all the radio and television programs on the air at one time." "Ask a foolish question and get a foolish answer every time" I laughed. After thanking Bill for the tour of the laboratories and for his cooperation, I surrendered my Visitor's badge to the Security Guard and headed for home. The visit with Bill had fired my imagination to a fever pitch, the boredom of last night had vanished. In my mind's eye I could visualize an array of equipment intercepting messages from distant stars transmitted on beams of light.

Finishing my supper in half the usual time, I asked Edith, hoping for a negative answer, "Have you anything special you want to do tonight?" "No" she replied, "But you can take the dog for a walk while I wash the dishes". Grumbling under my breath, I put on my coat and attached the leash to the dog. As we walked down the street, I resolved never again to own a dog. Every bush and tree that mutt paused at, inspected, and left his calling card. I didn't have a dog, it was a sprinkler system.

Back in the house, I picked up the phone and called Toby Timpson. Toby and I have worked together many times in the past. He loved to tinker. Like the time he added a sweep circuit to a standard 455 kc signal generator just so he could view the tuning of the i.f. circuits on his oscilloscope. While the phone was ringing, I was secretly hoping that he still had one of his telescopes he used to build, after all, Toby was one of those people that never threw anything away.

"Hello" answered the telephone. "Toby?" I queried. "Yes, who is this?" he replied.

"It's Jim, you old coot." I tittered. "Land sakes Jim, where have you been keeping yourself?" he asked. "The usual excuses Toby" I replied, "Just too many irons in the fire." "What's on your mind Jim, for if I know you, something's cooking" he laughed. "I think I have a project you will be interested in Toby" I said. "Well why not come over and let's discuss it?" he invited. "Are you sure you're not busy?" I asked. "Gosh no Jim" he replied, "Besides it will get me out of cleaning the basement tonight". "In that case I'll be over in about an hour" I answered, "So heat up the coffee pot." "I'll be looking for you, bye now," he returned.

I hate to admit it but it had been more than a year since I was over to Toby's house last and was frankly surprised to see the homes on one side of the street being demolished to make way for new commercial buildings. As I wheeled into the driveway, the porch lights came on, warm and invitingly, and Toby stood in the open doorway. "Hi Toby" I called. "Come on in, Jim" he invited, "It's cold out there."

"Whats happening across the street Toby?" I asked as he took my coat. "Progress I guess Jim", he replied, "and I don't think it will be too long before they start tearing down this side either." "Thats too bad" I sympathized. "Had a fine letter from Toby Jr. today, Jim" he boasted, "He's just been promoted to Captain and is stationed in Japan" "My how time flies Toby, did you know I was a Grandpa now?" I asked. "You're getting up in years too Jim, we're not as young as we used to be" he reflected, "but tell me was it a boy or girl?" "A girl" I beamed, "The first girl in the family". "Thats great Jim, but now tell me about your project" he asked. "First Toby, do you still have one of your telescopes around?" I asked. "I might have one in the basement Jim" he replied, "What do you say we go take a look?"

"Don't tell me you are going in for girl watching Jim" Toby said as he ducked under the low overhang at the landing, "Watch your head" he warned. "No" I replied, "I am planning on listening to the stars" "Ha!" Toby laughed, "I always knew you had a soft spot in the head" "You'd laugh out the other side of your mouth if you had read Frank Edwards new book" I ribbed, "It's all about UFO's and space communications".

We had arrived at the bottom of the

stairs and about us a multitude of cardboard boxes were stacked, leaned, and overflowed the basement. Here and there were stacks of old *Radio-Electronics* magazine, *Popular Mechanics*, and other trade and mechanical publications, Toby's Library. "Don't you ever throw anything away?" I asked Toby, as I ogled the piles of skeleton surplus radio chassis. "Never can tell when I'll need something" Toby grinned, "Take this telescope for an example". He was withdrawing a long dusty tube from under the rafters and wiping off some of the cobwebs. "Haven't had this out in maybe 10 years or longer". "Think it will still work?" I asked. "Give me ten minutes and she'll be ready to use" Toby replied, "Just a matter of blowing out the dust and cleaning the mirror."

True to his word, a quick blowing from the air hose and the dust seem to vanish like magic. He then carefully brushed the mirror with a camels hair brush and wiped the viewing lens with tissue. "There" he said, "As good as ever", "Now about that project Jim." "How powerful is this telescope Toby?" I asked. "Well its a 6 inch reflecting model and with a Barlow lens, I'd say about 400 power magnification" Toby informed, "Good enough to see the rings around Saturn". The telescope was about six feet long and stood on a sturdy tripod, ideal for my project.

"Well the idea is Toby, to use the telescope to beam light into a monochrometer and detector tube in hopes of picking up light communications from the stars" I revealed. "What in blazes is a mono-mono-chrometer?" Toby asked in a note of perplexity. "You might call it a tuner for light" I replied, "Just like the tuning of a radio only light waves are resonated instead of radio frequencies." "You'd better watch out" Toby laughed, "The little men in white coats will be after you," "Imagine, sending messages on beams of colored light, Ha!" "But Toby" I injected, "There's more to light than what we are capable of seeing, we see less that 10% of the spectrum known as light".

"Well, I'll take your word for it" Toby chirped, "But I'm from Missouri and you'll have to show me!" "You're on" I grinned, "Now have you a photomultiplier tube anywhere?" "Photo-who?" Toby replied. "Where's your Allied catalog Toby, we'll look it up" I said as I fumbled through some of his magazines on the work bench.

"Ah! here is one" I remarked, "Good old Allied, not only a wish book but a ready reference for surplus identification". Toby had meticulously salvaged all the tubes from his stock pile of surplus electronic equipment and sorted them according to their types. "We need a 8053 tube" I stated and Toby began rummaging around some boxes. "The nearest I can come to it is type 8054" he advised, "Can you use it?" "Perfect" I gleefully shouted, "That's a sintillator detector tube, just what we need".

Taking the loot upstairs, I conferred with Toby as to what we would do. I would assemble the equipment at my place, borrow the Monochrometer from Bill and the three of us would try to tune in space this weekend. "You're not leaving now?" Tony whined, "Its still early in the evening". "Yes" I replied, "'Cause if I don't get home early tonight, Edith will properly put the skids on my plans for the weekend." "Be sure to call me as soon as you have it finished." Toby begged, "You have me as excited as the day I got married." I donned my coat and buttoned it up tightly because to carry the telescope home in my car meant sticking it out the window and brother, it was cold outside. Toby helped me carry out the equipment and with a brief "Goodnight" I was homeward bound.

The next night I began to assemble the various items. From the junk pile I found a small 2000 volt d.c. power supply, it had been used with a neon tube experiment several years ago. I just had to add a small seven amp powerstat in the a.c. line to adjust the input voltage so I had 1500 volts d.c. at the output. Next I arranged a number of two watt resistors in series on a piece of vector board to provide the voltage gradient required for the PM tube's ten dynodes and plate load resistor. Plugging in the 8054 tube completed the light detector circuit.

To amplify the output of the PM tube, I got out a small Heathkit Audio amplifier and to this I connected a modified Eico Signal Tracer for demodulation of either a.m. or f.m. signals. Lastly I added the speaker and connections for the tape recorder and tested the setup. All I needed to run the test now was the Monochrometer.

Friday morning I called the Research Plant and asked for Bill. "Bill" I questioned, "What are the chances of borrowing one of your Monochrometers?" "Jim" he replied. "I hate to disappoint you but it would be im-

possible to loan company equipment to anyone." "But Bill" I pleaded, "I have everything ready to go, the telescope, PM detector, amplifiers, and recorder. All I need is the Monochrometer. Would there be any objection if YOU borrowed it?" "I'll check into it Jim and call you back." Bill advised. "Thanks Bill." I said, "I'll await your call." It was several hours before Bill returned the call. "I have permission to borrow the Monochrometer" Bill gleefully exclaimed, "I'll bring it over to your house tonight." "Fine" I replied, "I'll call Toby and we'll give it a workout tonight".

After supper, I called Toby and asked him to come over around seven, adding that we were ready to go with the project. Wrapped in a sweater and heavy coat, I proceeded to set up the equipment in a dark corner of the back yard. To make the job a little more comfortable, I placed a folding screen around the equipment and fired up a surplus gasoline space heater. Tonight's temperature would be in the low 30's promised the weatherman. Chilled to the bone, I managed to extend the power from my shop to the equipment by means of extension cords. It was worth the numbness from the

cold, for all units were operating perfectly.

Bill and Toby arrived a little after seven and in little or no time we had the Monochrometer attached to the telescope. Working as a team, Bill adjusted the Monochrometer's frequency, Toby operated the telescope, and I ran the amplifiers and tape recorder.

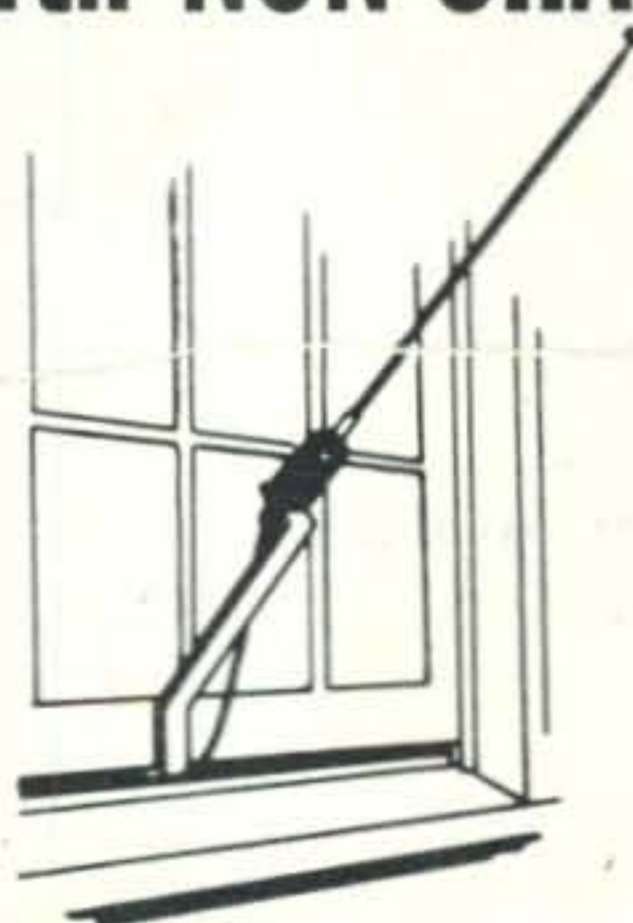
Hours went by but all we could hear on the speaker was the high gain hum of full volume without a signal of the amplifier. Cold, shivering, and ready to call it quits, the three of us hovered about the space heater. "Let's make one more try" said Toby, "Then I'm going home before I catch pneumonia." "Me too" echoed Bill, "But let's try another sector of the sky first". As Toby swung the telescope through azimuth, suddenly the hum of the speaker changed its pitch. A frying-like noise developed and faintly in the background came the sound of "Belzt Plass Muba". Wild with excitement, we whooped and hollered, danced around slapping each other on the back. Bill checked the Monochrometer and advised it had been set at 633 millimicrons, the frequency of the Ruby Laser and the playback of the recorded tape distinctly produced three

[Continued on page 110]

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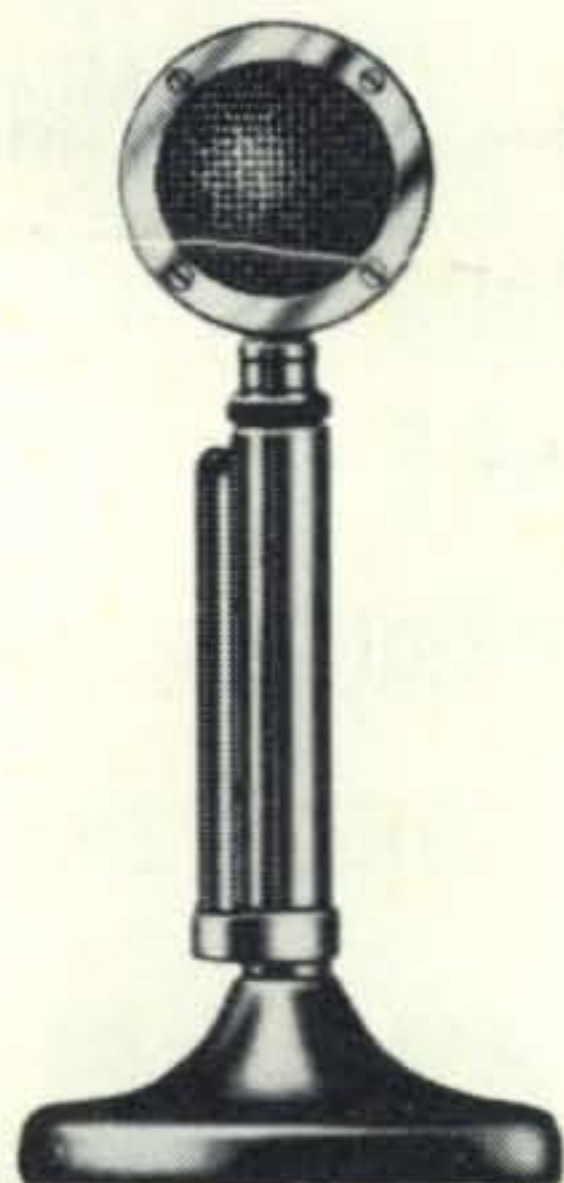
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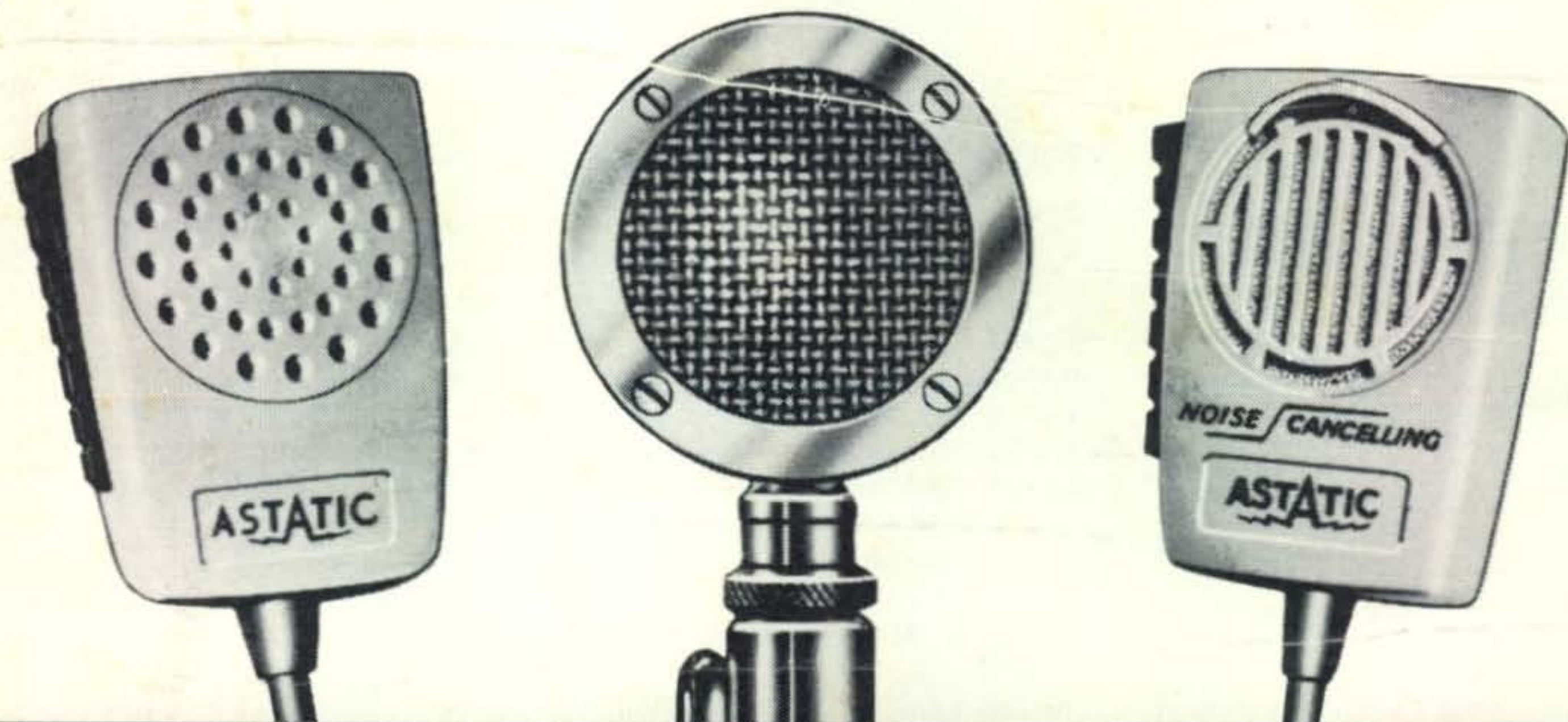
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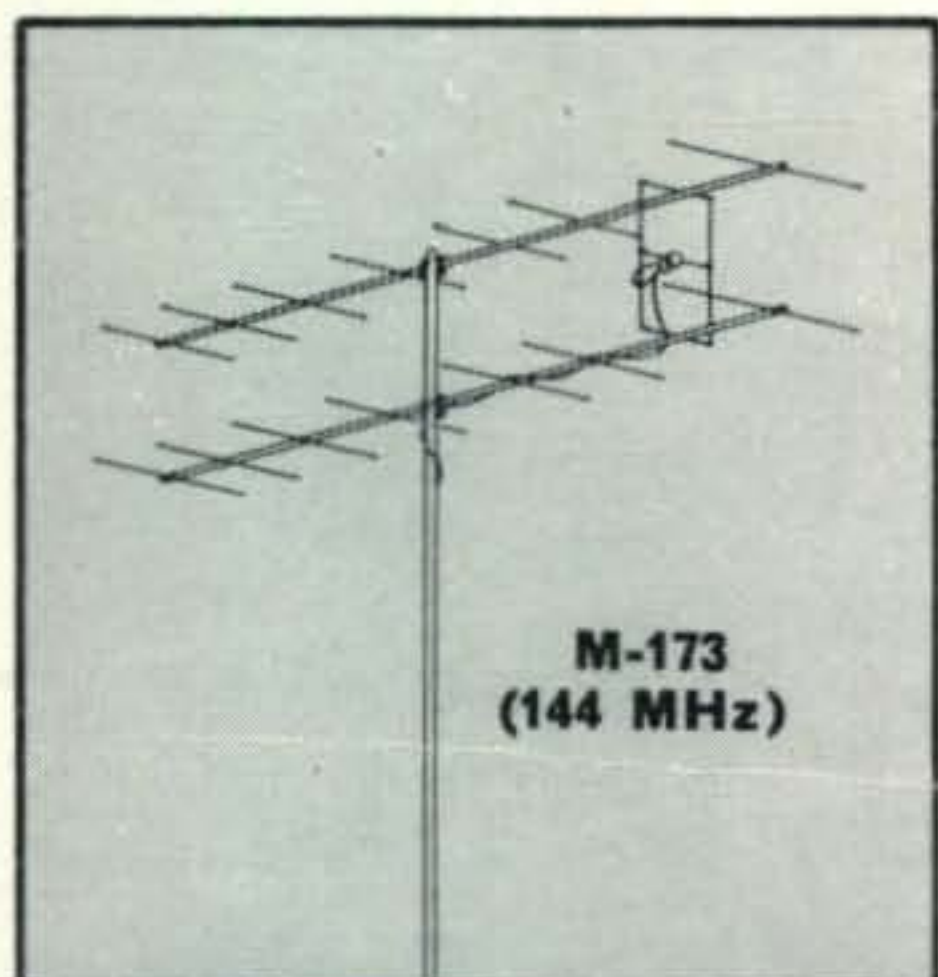


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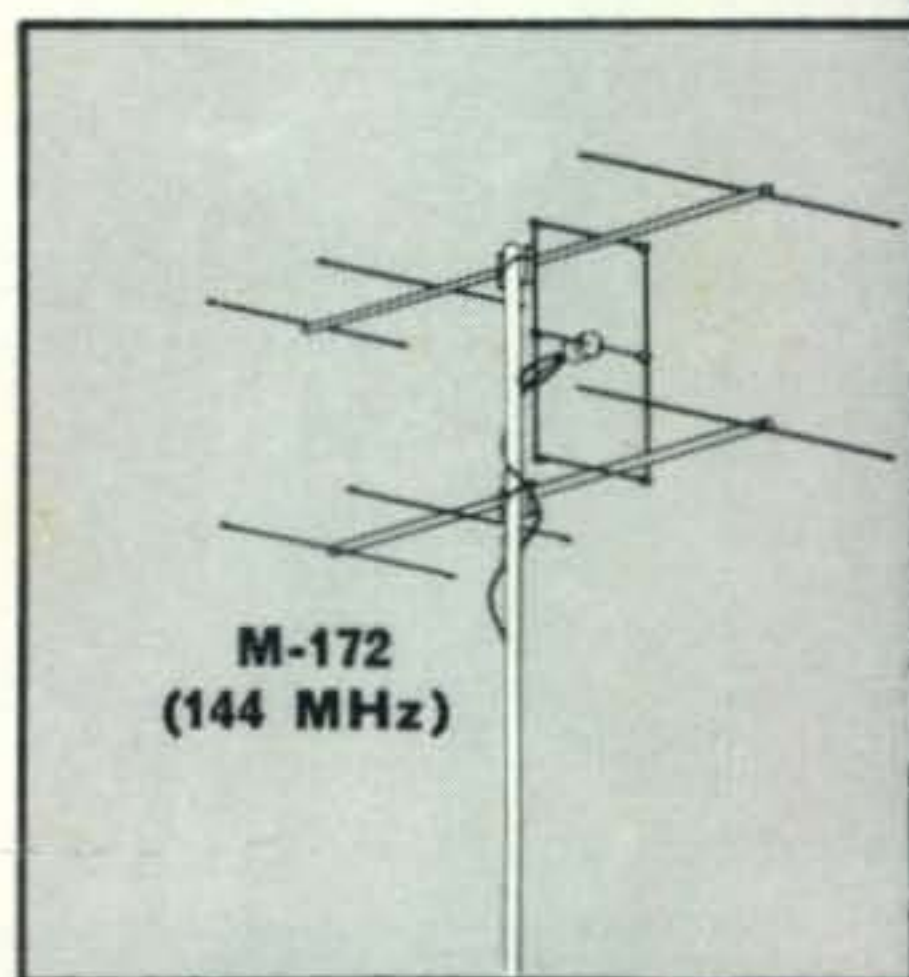
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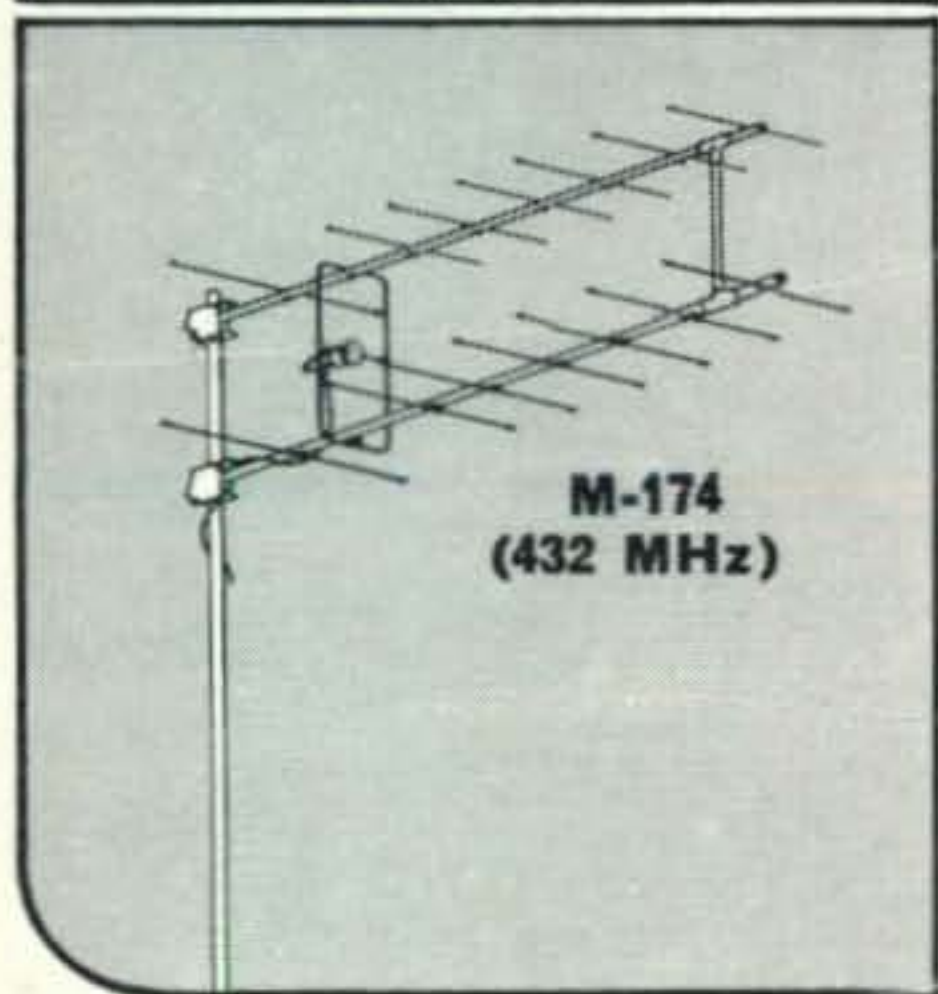
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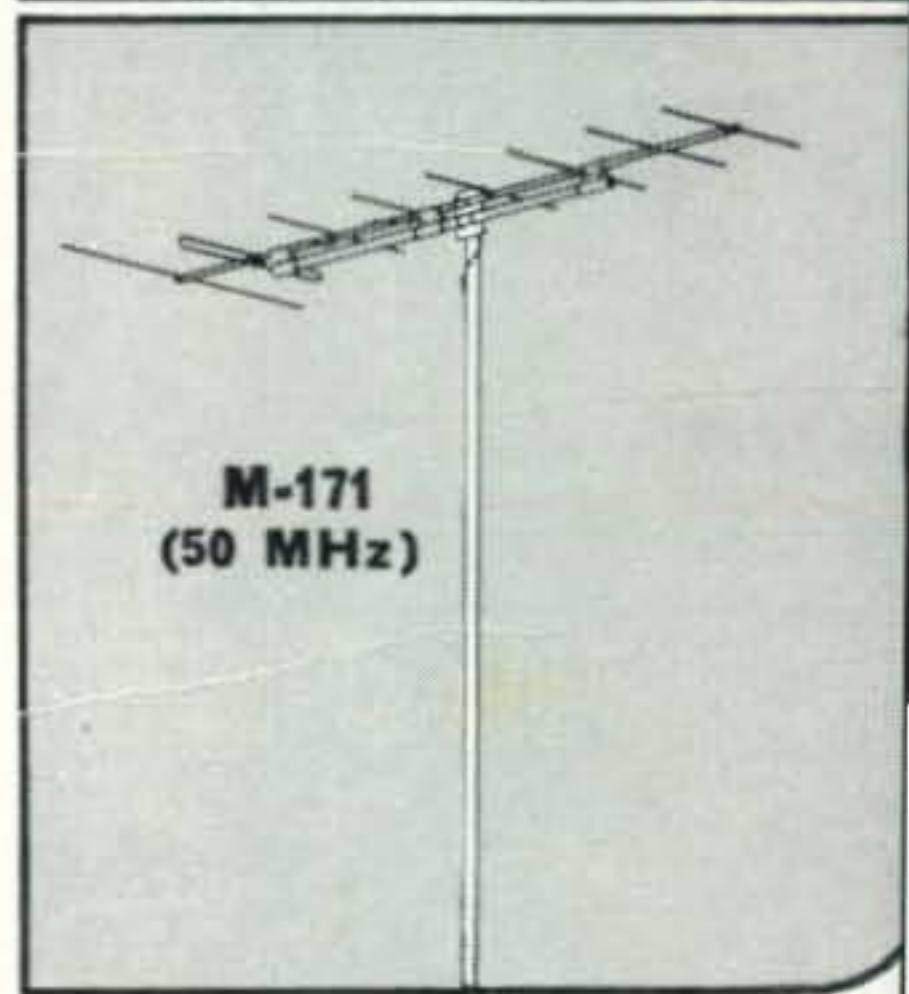
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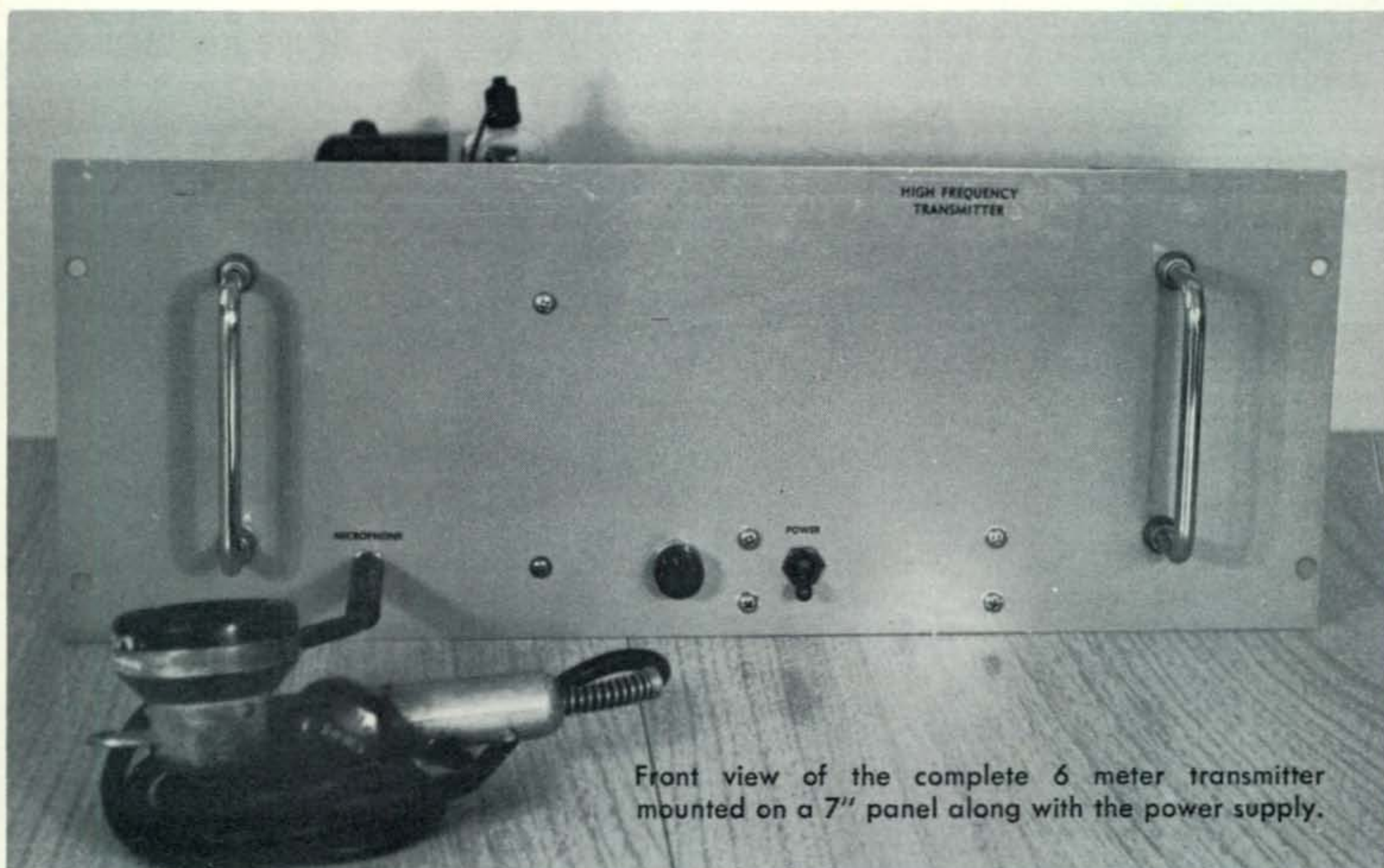
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Front view of the complete 6 meter transmitter mounted on a 7" panel along with the power supply.

BY SAM KELLY,* W6JTT

THE change in police frequencies from the old 40-50 mc band to the new v.h.f. frequencies has dumped a considerable amount of the old n.b.f.m. equipment on the surplus market. A unit of unusual interest to hams is the Link 40 FT-4 (and similar models) motorcycle f.m. transmitter. This is a very compact transmitter putting out about 10 watts of 5 kc deviation f.m.

I needed a single channel transmitter for 6 meters (and 49 mc MARS) net use. These units were available at the unbelievable price of 96¢ each (less tubes). The original tube line up was a 12AT7 crystal oscillator frequency modulator, 6BJ6 multipliers, a 6AK6 buffer/doubler and a 2E26 final. To keep the cost at a minimum the multiplier and driver tubes were replaced with 6AU6's which are available surplus for 19¢ each. Since both the cathode and suppressor leads of the original tubes were grounded it is possible to use the 6AU6's as direct replacements. Not having a 2E26 in the junk box I used a 5933. This requires replacing the octal socket with a 5 pin type. A 6146 can be used with no wiring changes.

* 12811 Owen Street, Garden Grove, California 92641.

Modifications

The first step in getting on the air is to remove and discard the antenna connector strip (which has an r.f. choke connected between the two u.h.f. connectors), the two power connectors and the two 6 volt relays. The remaining leads are readily identified. The carbon microphone lead goes directly to the microphone transformer, the filament lead goes directly to a filament pin on a multiplier tube, the B+ lead which goes directly to the filter capacitor, and the antenna lead from the link.

Next, remove the four screws holding the final tank coil assembly. This will allow you to work on the tank coil. Remove one turn from the end of the coil that goes to the r.f. choke. Replace the four screws and tighten securely.

Remove the capacitor shunting the buffer/double stage (X-6) and replace it with a 12 mmf ceramic. Open the B+ lead going to the final tank assembly and bring it out separately so that you can run the final at a higher plate voltage than the multiplier chain.

Mount the transmitter to a standard 7 inch EIA panel as shown in the illustrations

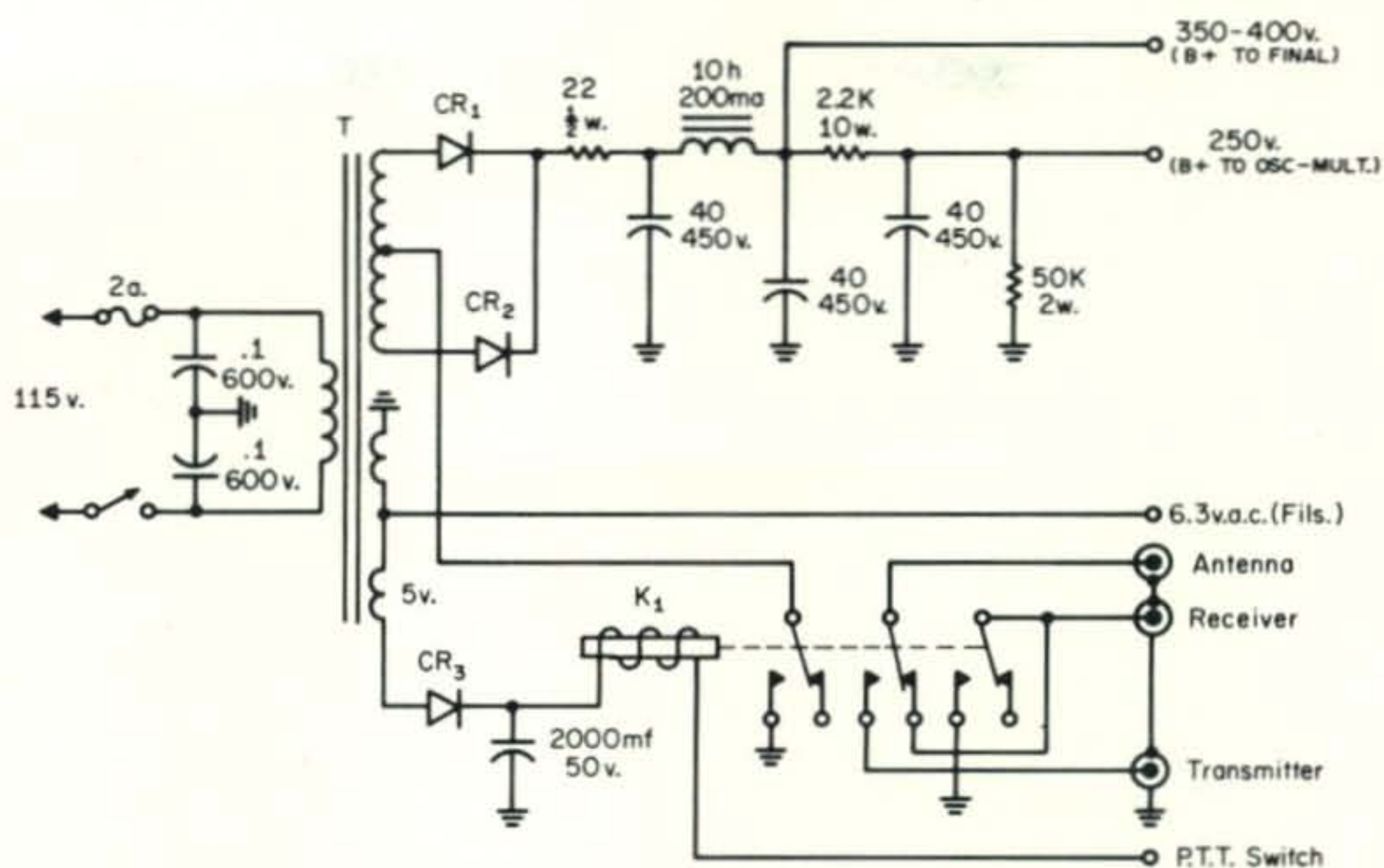
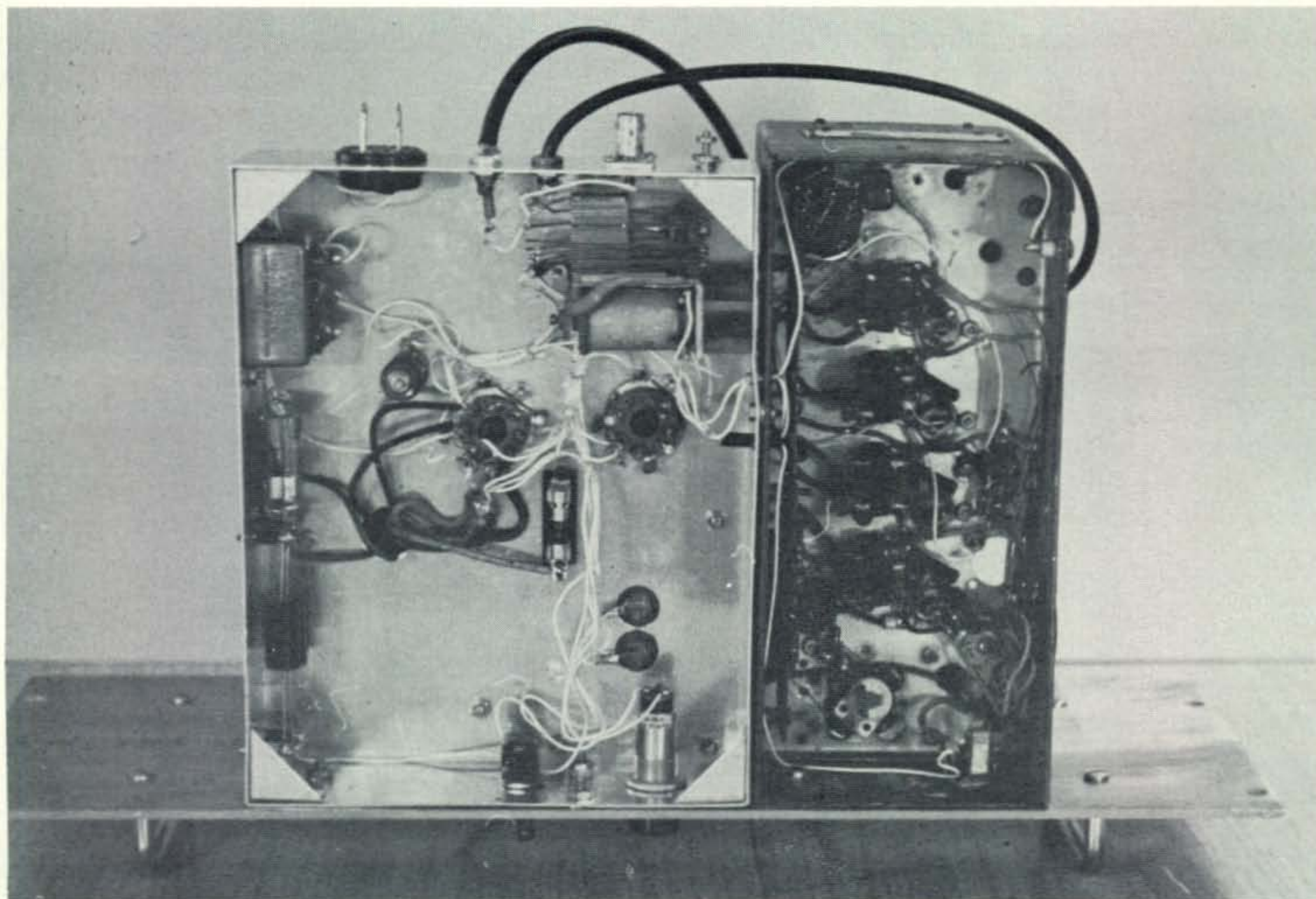


Fig. 1—Circuit of the power supply and control circuit used to power a modified Link 40 FT-4 surplus narrow band f.m. transmitter. All capacitors shown are in mf.

CR₁-, CR₂-750 ma diodes, 1000 p.i.v.
CR₃-750 ma diode, 50 p.i.v.

K₁-Relay, 28 v.d.c., 3 p.d.t.
T₁-350-0-350 v. at 150 ma, 6.3 v. at 3 a., 5 v. at 2 a.



Bottom view of the finished 6 meter transmitter showing the power supply and the Link 40 FT-4.

Pin # Function

1	Ground
2	Grid current, 1st 6BJ6
3	Grid current, 2nd 6BJ6
4	Grid current, 3rd 6BJ6
5	Grid current, 6AK6
6	Grid current, 2E26
7	Filament voltage
8	P.A. Plate current 100 ma = 2.2 V
9	

Table 1—Metering functions of the test socket.

with the modulator/oscillator end towards the panel. Install a three wire microphone jack. This completes the conversion of the transmitter.

Tuning and Operating

The power supply and control circuits were built on a separate chassis. Figure 1 is the schematic diagram of this assembly. After completing the wiring and smoke testing plug in a crystal in the 1.565 to 1.685 mc range. This transmitter was designed to operate on the 32 harmonic of the oscillator. Allow the transmitter filaments to warm up before pushing the press to talk switch.

Use a VOM or VTVM to measure the grid currents of the multiplier stages. Table I lists the pin numbers of the various metering circuits. Starting with the grid of the first multiplier tube (pin 2 of the metering socket) adjust the tuning slugs for maximum grid current. Dip the final amplifier using the capacitor closest to the output tube. The other capacitor is the loading capacitor and should be adjusted for maximum output as evidenced by an increase in plate current.

Using the power supply described, you will have about 350 volts on the plate of the 5933. Power output will be about 18 watts. I ran the transmitter into a dummy load for two hours without any evidence of overheating.

You may get the temptation to jack up the final amplifier plate voltage for increased power. Remember, the plate bypass capacitor is rated at 600 volts, and the tank capacitors are receiving type APC's with very close plate spacing.

TVI

In operation it was found necessary to make an aluminium bottom plate to cover both the power supply and transmitter. An external TVI filter is used. The total cost of the transmitter and power supply as shown was \$14.30—a lot of performance for so low a cost! ■



Top view of the 6 meter transmitter using a Link 40 FT-4 shows the Link unit on the left with the modulator/oscillator section closest to the front panel.

A vertical antenna is shown against a sunset background. The sun is a large, bright white circle in the upper left. The sky is a textured orange. The antenna is a thin vertical pole with a horizontal cross-arm at the top. It is supported by a base on a dark silhouette of a hill, with several guy wires extending from the base to the ground.

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HY-GAIN ANTENNAS, FOR THE MOST POWERFUL SIGNAL UNDER THE SUN
New Readers Service on Page 120



A SMALL SIGNAL TRANSISTOR TESTER

BY WM. M. TURNER,* W4MND

This simple transistor tester makes use of an outboard v.t.v.m. or v.o.m. to reduce costs. It is very useful when testing small signal transistors but it is not good for power transistors. The tester measures d.c. beta, I_{cbo} and I_{ceo} .

This article describes a simple transistor tester which will measure current gain (Beta) and leakage currents of small signal transistors. The tester uses the normal station v.t.v.m. or vom for the indicating instrument thus eliminating the need for an expensive microammeter. While the accuracy of measurement is not precise it is adequate to indicate proper operation of most transistors.

Principle of Operation

The schematic diagram of the unit is shown in figure 1. With S_2 in the GAIN position it will be noted that the transistor under test is placed in a common emitter d.c. amplifier circuit. (See fig. 2 for simplified schematic.) In this configuration the

d.c. current gain, Beta, will be indicated directly on the meter if the values of R_F and R_L of fig. 2 have been chosen properly. The equation for Beta in this configuration is:

$$(\text{Beta}) \beta = V_{RL} \left(\frac{R_F}{V_{CC} R_L} \right)$$

where:

β = d.c. current gain.

I_C = d.c. collector current.

I_B = d.c. base current.

V_{RL} = voltage drop across R_L .

V_{CC} = battery voltage.

The equation assumes base-emitter voltage and leakage current are negligible. If $R_F/V_{CC}R_L$ is made equal to 1, 10, 100, 1000 etc., the meter will indicate Beta directly in terms of V_{RL} .

For example, if a transistor with a β of 50

* 3624 Squire Lane, Orlando, Florida 32806.

was placed in the circuit of fig. 2 the following conditions would exist:

$$\begin{aligned}\beta &= 50 \\ R_F &= 270K \\ R_L &= 3K \\ V_{CC} &= 9v \\ V_{cc} &= 9v\end{aligned}$$

By substituting in the above equation we can solve for V_{RL} .

$$\begin{aligned}\beta &= V_{RL} \left(\frac{R_F}{V_{CC} R_L} \right) \\ 50 &= V_{RL} \left(\frac{270 \times 10^3}{9 \times 3 \times 10^3} \right) \\ 50 &= V_{RL} \quad 270/27 \\ 50 &= V_{RL} \\ V_{RL} &= 5\end{aligned}$$

Knowing beforehand that Beta is equal to 50 it is simple to see that the v.t.v.m. reading of 5 volts merely has to be multiplied by 10 to determine Beta. Returning to fig. 1 again we see that in order to set up the circuit of fig. 2, S_1 must be in the LOW β position and S_2 in the GAIN position.

If S_1 is set to HI β the multiplication factor is 100 rather than 10. This is because switching S_1 to the HI β position increases R_F from 270K to approximately 2.7 meg (2.67 to be exact) by placing R_2 in series with R_1 . The new ratio of $R_F/V_{cc} R_L$ is

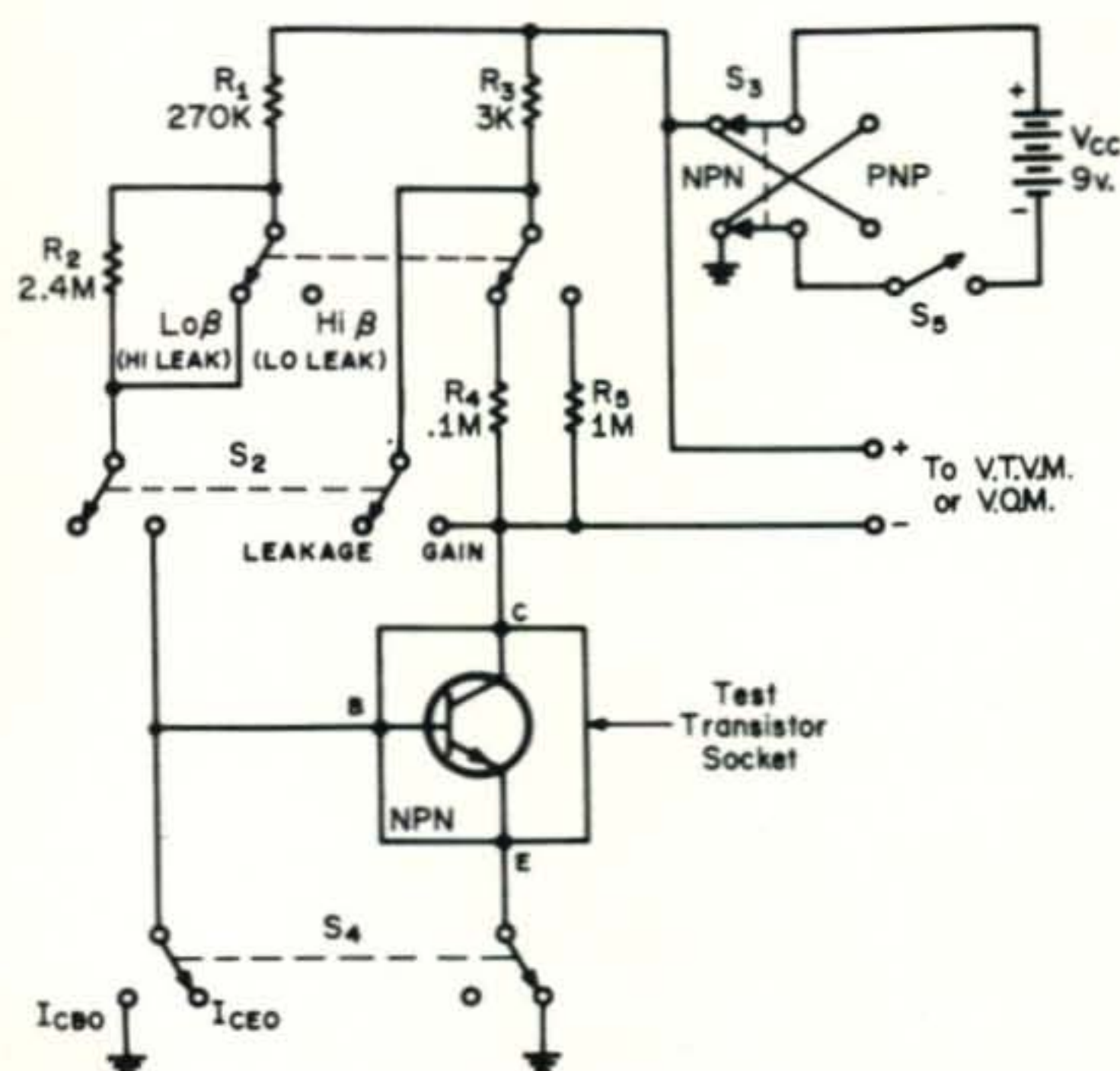


Fig. 1—Circuit of a small signal transistor tester. The meter polarity shown is to be reversed for p.n.p. transistor tests. Switch S_4 is shown in the position for all measurements except I_{cbo} . Switch S_5 is needed only if S_3 does not have a center-off position. All resistors are $\frac{1}{4}$ watt.

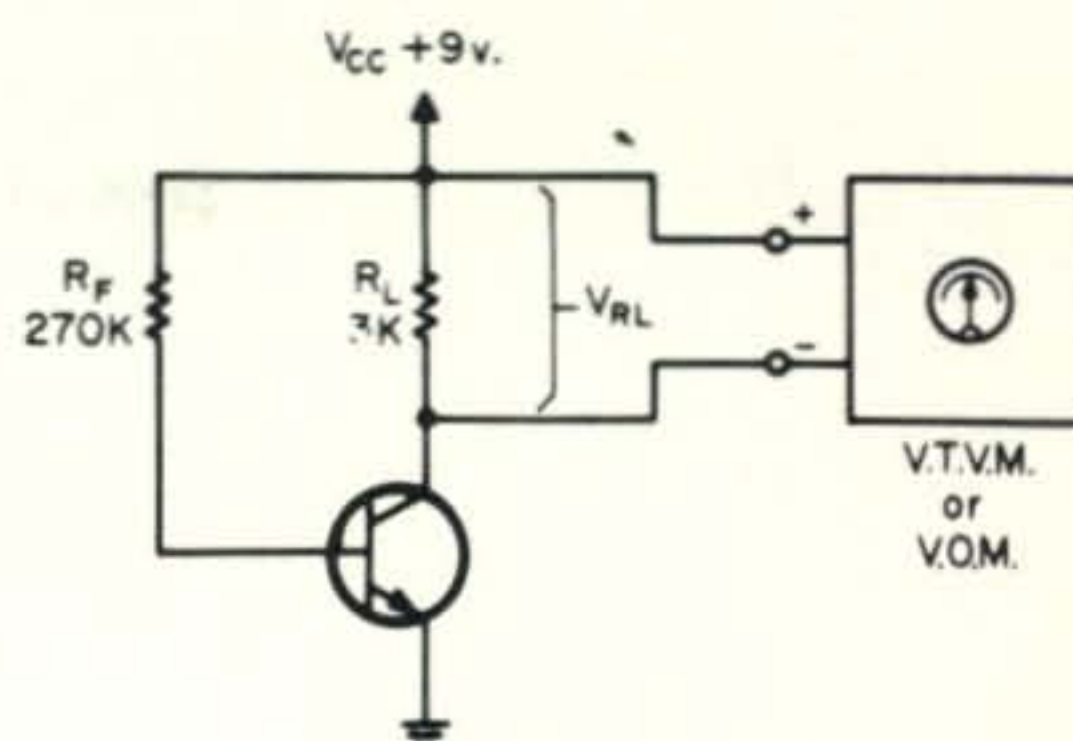


Fig. 2—Simplified circuit used for d.c. current gain (β) measurement in fig. 1 with S_1 in Lo β and S_2 in Gain position.

now changed from 10 to 100.

Leakage current may be measured by placing S_2 to the LEAKAGE position. With S_4 placed as shown in fig. 1 the collector-emitter leakage current (I_{CEO}) may be measured. See fig. 3 for simplified schematic. If R_L has been chosen properly the meter will indicate directly as a function of leakage current. For example, if $R_L = 100K$ and the leakage current is 10 microamperes the voltage measured across R_L will be 1 v.d.c. Therefore to obtain the leakage current in microamperes the meter reading should be multiplied by 10. If S_1 is placed in the LO LEAK position ($R_L = 1M$) the meter will indicate the leakage current directly in microamperes (multiplying factor of 1). For example if the meter reads 3 v.d.c. the leakage current is 3 microamperes.

To measure the collector-base leakage current I_{CBO} , S_2 is left in the LEAKAGE position and S_4 is placed in the I_{CBO} position. The circuit will be set up as shown in fig. 4. Leakage current may be read in the same manner as for I_{CEO} . The absolute value depends on the position S_1 for the multiplying factor.

Meters for Use with Tester

For Beta measurements almost any vom or v.t.v.m. may be used. It is suggested, however, that an instrument of at least 20K ohms per volt be used to minimize inaccuracies. However, the input impedance of the instrument should be 5 to 10 times R_3 for best accuracy.

When leakage current is measured the input impedance of the instrument should be at least 5 to 10 times R_5 , or 5 to 10 megohms for best accuracy. This requirement makes it necessary to use a v.t.v.m.

Construction

The unit can be built in almost any form

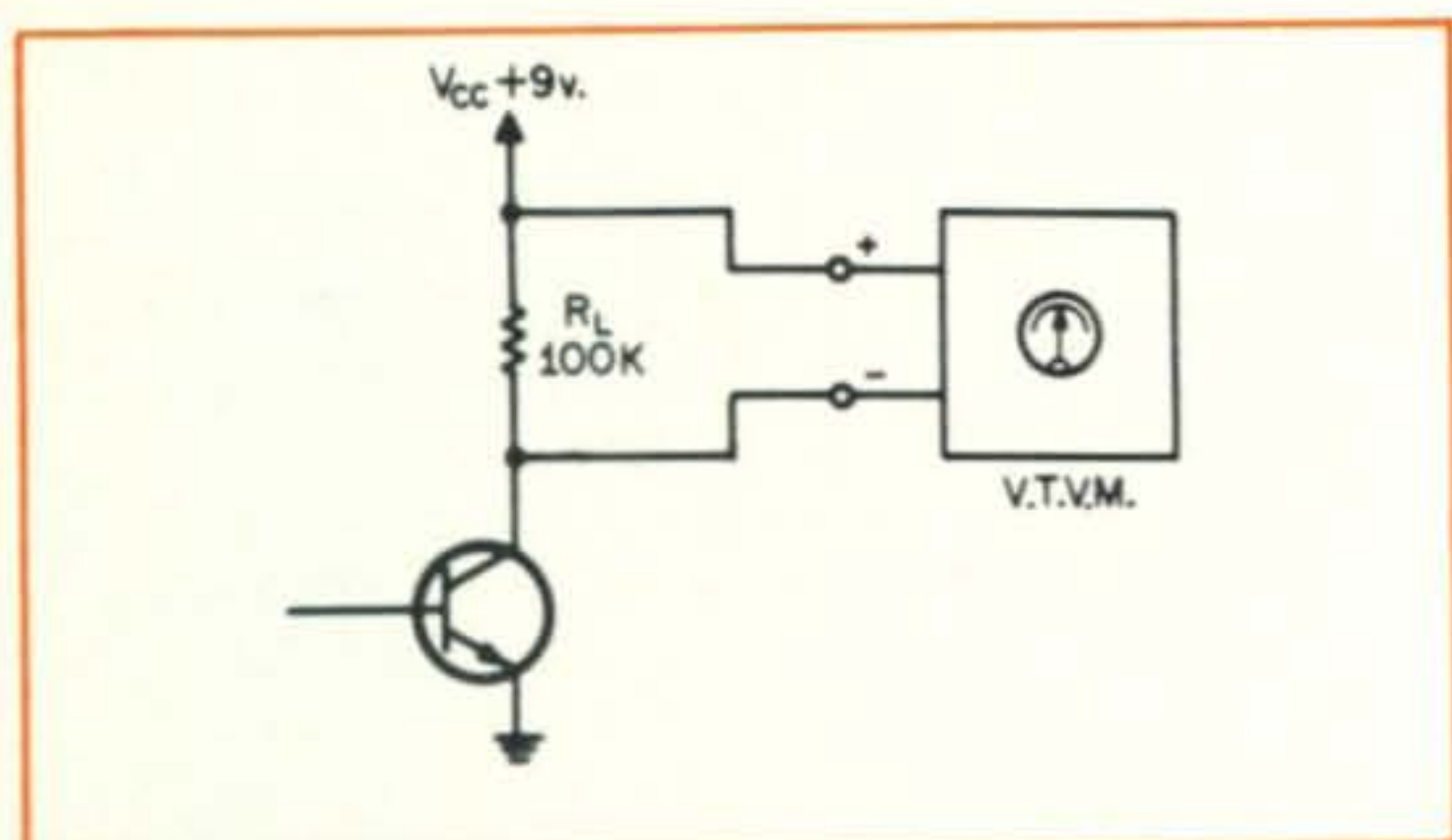


Fig. 3—Simplified schematic for measurement of I_{CEO} in fig. 1. The meter used to measure V_{RL} must be a v.t.v.m.

as the layout of parts and wiring is not critical. At this station the unit was built in a $2\frac{1}{4} \times 2\frac{1}{4} \times 4$ inch minibox. A transistor socket and all the switches were placed on the panel of the box. Two meter jacks were added on one of the $2\frac{1}{4} \times 2\frac{1}{4}$ inch panels. A small 9 volt battery was permanently installed inside the box. The switches were marked as shown in fig. 1. In addition, the following was typed on a piece of paper and glued to the minibox for reference purposes:

Leakage

1. Switches to LEAKAGE and I_{CEO} .
2. Read I_{CEO} as below.
3. Switch to I_{CBO} .
4. Read I_{CBO} as below.
5. HI LEAK position: $1V = 10\mu a$.
LO LEAK position: $1V = 1\mu a$.

D.C. Beta

1. Switches to I_{CEO} and GAIN.
2. Read Beta as below.
3. HI BETA position: $\text{Beta} = \text{Volts} \times 100$.
LO BETA position: $\text{Beta} = \text{Volts} \times 10$.

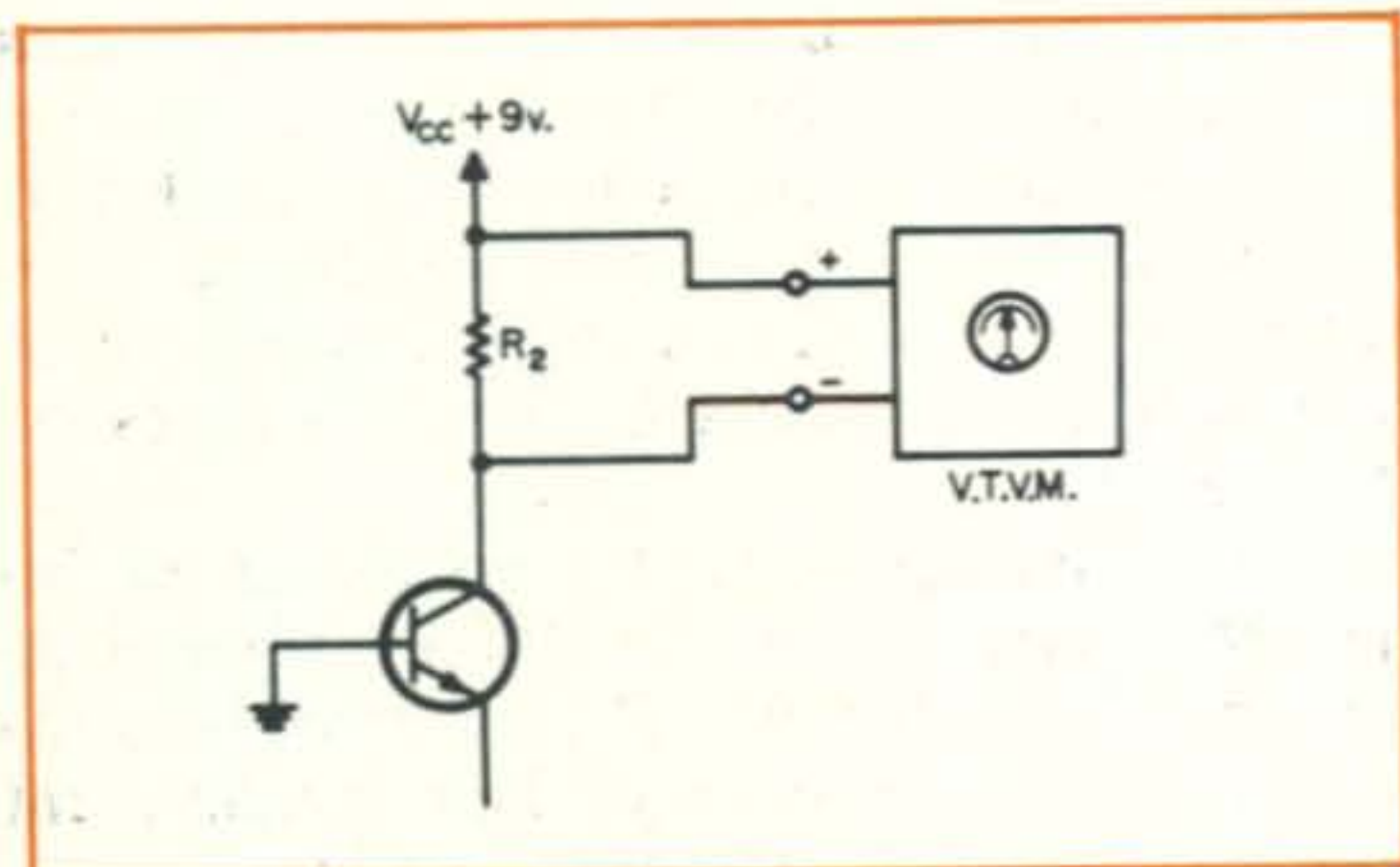


Fig. 4—Simplified circuit used to measure I_{CBO} in fig. 1. The meter used to measure V_{RL} must be a v.t.v.m.

A push button switch was employed for S_4 as this would allow the circuit to be used for Beta and I_{CEO} measurements without having to remember to place it in the proper position. A d.p.s.t. toggle switch could be used here if desired. Switch S_3 is a double pole, double throw type with a center-off position. This switch is used to reverse the battery polarity so that either p.n.p or n.p.n. transistors may be tested. With S_3 in the center-off position all power is removed from the circuits. Switch S_3 could be a normal d.p.d.t. toggle with another switch placed in series with the battery remove power from the unit.

Using the Tester and Interpolation of Results

In testing the suspected transistor, check its leakage first as this is the most sensitive check of the condition of the transistor. The leakage currents obtained can be compared with the manufacturers data if they are available. In small signal transistors an I_{CBO} reading of 10 to 15 or less would most likely constitute a good transistor. The lower the leakage current the better the transistor. A full scale meter reading (approximately 9 v.d.c.) during leakage measurements indicates the elements (collector-emitter, base-collector or base-emitter) under test are shorted. No meter indication suggest either extremely low leakage currents or the elements under test are open. The gain test to be performed later will determine which is the case. I_{CEO} readings of 50 microamperes or less are typical for most common types of transistors passing 1 to 10 ma of collector current. However, values of I_{CEO} are seldom found in data sheets for the newer transistors. The I_{CBO} measurement is a better indication of the transistors condition especially if it is used in the common emitter configuration.

Once it has been determined that the leakage is within acceptable limits the d.c. current gain is next checked. No typical values for d.c. current gain (Beta or h_{FE}) can be given here as they range from 5 or so to several hundred depending on the type of transistor. However, a Beta of 5 should at least indicate the transistor will amplify to some degree in the circuit.

Other points to keep in mind when checking transistors are:

1. The most desirable condition for a low

frequency transistor is low leakage and high Beta.

2. As leakage current increases Beta decreases.

3. When using this tester large leakage currents will cause errors in Beta measurements.

4. Transistors have d.c. and a.c. Beta's. For low frequency transistors these Betas are somewhat related. However, in high frequency transistors there is no simple direct relation.

5. High frequency transistors generally have lower d.c. and a.c. Betas than low frequency transistors.

6. If several transistors of the same type are available compare the suspected transistor against them.

7. D.c. Beta can vary as much as 100% from unit to unit for the same type transistor.

8. The transistor tester outlined here will not measure power transistors accurately as the current levels of the instrument are too low.

Testing Diodes

The tester described here can also be used to test diodes for opens or shorts. To test a diode place its anode lead to the collector pin of the transistor socket and the cathode lead (usually the banded end) to the emitter pin. Set up the tester to read I_{CEO} for n.p.n. transistors. Note the meter indication. Reverse the diode lead and again note the meter indication. If the first meter indication is at least 5 to 10 times the second, the diode is satisfactory. If the 1st and 2nd meter indication are equal the diode is shorted. If no meter indication is obtained in either reading the diode is open. Two leads could be connected from the collector-emitter pins of the transistor socket to special terminals if desired to facilitate diode testing.

Conclusion

This tester has been in operation at this station for over two years and has been an invaluable instrument for building and troubleshooting transistor circuits. The Beta measuring circuits have been compared with more expensive and elaborate instruments and found to be in close agreement. Other battery voltages can be used as long as $R_F/V_{CC}R_L$ is made equal to the desired multiplying factor. ■

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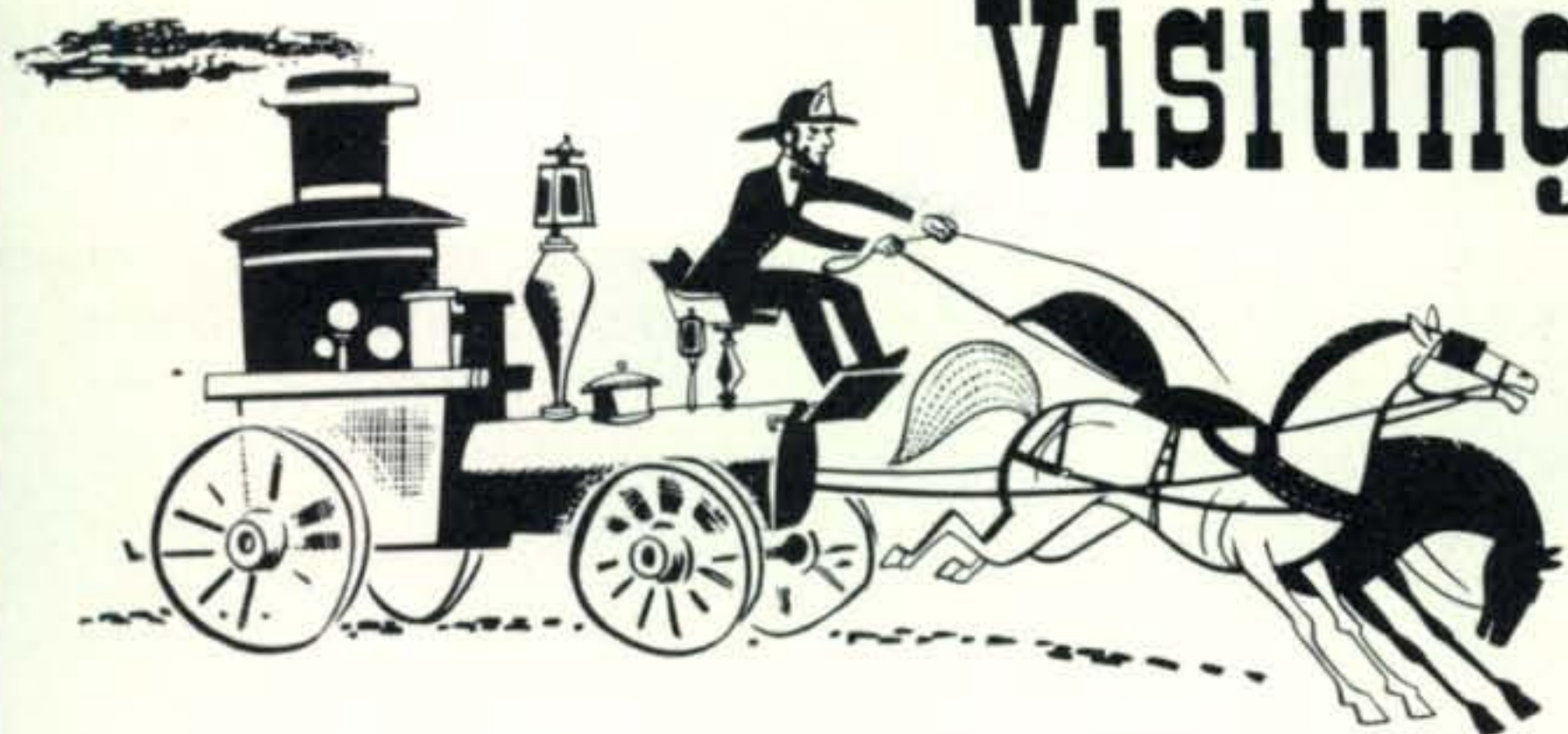
PRICE: SS-IBS \$1200, SS-1S \$135, SS-1V \$445



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New Readers Service on Page 120



Visiting Firemen And The Good Old Days

BY SYLVIA MARGOLIS*

"FROM the moment I arrived, I was made to feel like the President of the Society!" said Graham Hicks, W5IHP, after his day at the 1967 International Radio Engineering & Communications Exhibit in London.

A nicer man couldn't have said a nicer thing. But what he experienced in London was no accident. Nor was his an isolated case, but the end product of months of planning, trial runs and collaboration between a handful of volunteers and a Radio Society of Great Britain which is becoming as noted for its forward-looking policy and receptiveness to new ideas as for its professional distinction. What Mr. Hicks enjoyed was part of the Society's *Welcome to London Program*, which has been operating since the beginning of 1967.

Radio amateurs coming to London are invited, through the amateur radio press, to call on the services of the Program if they need advice, assistance, or if they just want to meet British radio amateurs.

*95 Collinwood Gardens, Clayhall, Ilford, Essex, England.

Graham Hicks was one of our "clients." He had acceded to our request, in the amateur radio magazines, that he should write to us beforehand, to let us know he would be coming and giving a few personal details about himself, so that we could be prepared for his visit. Applicants who do this can be sure of a much more effective—and a warmer welcome—than those who call us out of the blue, with:—"Surprise, Surprise! It's me!" on a cold, wet Monday morning, when the washing machine has seized up, the third member of the family has gone down with flu and we missed the PYØ the night before!

The dates Graham had chosen for his trip were lucky ones, for he would be able to take in the four-day Exhibition, the biggest amateur radio event in the world, *bar none!* There's little more the Program could offer its clients than this chance to look over the latest in European and American equipment, to admire the miracles of other people's home construction, to see lots of amateur radio celebrities and to meet R.S.G.B. on its own ground, as well as ten thousand other radio amateurs.



OD5LX with G3FZL.



G6CL, John Clarricoats, author of *The World At Their Fingertips*, with Dick Baldwin, W1IKE, Assistant General Manager of ARRL



More than 100 people at the Overseas Visitors' Reception.

One of the highspots of the Exhibition was the Overseas Visitors' Reception on Friday night. Foreign visitors were invited as guests of R.S.G.B. The British had to pay \$1 each for their tickets.

This led to a little trouble. When is a foreigner a foreigner? Lots of British amateurs hold overseas calls. Some of them have operated whilst working abroad. Some have been in remote areas to which they would never have gone, if their Country hadn't sent them, as members of Her Majesty's Forces. Then there are the scores of G's who now hold reciprocal callsigns, a growing new trend. You apply for your foreign call almost before you apply for your passport these days, when going abroad. My husband, G3NMR, for instance, holds calls, which he renews every year, in Belgium, Holland, Germany, Luxembourg and Austria. Joe Steele, G3KZI, revels in the exotic VP7EA. Norman Fitch, G3FPK, has, for years, held 3A2BT. Edgar Wagner, G3BID, has ZD3F, G3BID/CN and G3BID/6W8, as well as the mundane European callsigns.

Some pseudo-foreigners had claimed free tickets to the Reception, on the basis of



"A Happy New Year" from 4X4AC, Lt. Cdr. B. Maimon, Israeli Navy, and his wife, to R.S.G.B. President, GI3KYP, Barney Patterson (left.)

their "overseas" callsigns. This led to a degree of argument, but only in gentlemanly, understated British style, like:—"DROP DEAD!" about who was a foreigner and who wasn't. At least the Americans came out shining and innocent. This was one of the few occasions on which they could take advantage of that bit of nonsense back in 1776. Whether they liked it or not, they were foreign!

Each year more and more overseas visitors come to the Exhibition. There is always a big delegation from Holland and Belgium, a very pleasant annual tradition. It's more than 300 years since Britain fought Holland and, in the 140 years that Belgium has existed as a nation, we haven't fought her once. The links between the three countries are warm and enduring. Besides, it costs less than \$30 to get from Belgium or Holland to London, which is as good a reason as any for being friendly.

The Belgian and Dutch parties arrived all together, on one flight, an hour or so before the Reception was due to begin. This was the set-up. As you entered the Exhibition Hall, the first booth on the left-hand side was the long, long R.S.G.B. booth. It began with the Reception Bay, where a couple of R.S.G.B. Council members were always on duty, to receive members and visitors. The Reception Bay was, perhaps, 10 by 12 feet in area. The system worked beautifully when members arrived one by one. They signed the Exhibition Signing-in Book, exchanged pleasantries, or insults, with the Council representatives, then passed on into the main Exhibition.

When fifty foreigners arrived together, speaking a mixture of English, French and those linguistic gargles called Dutch and Flemish, it sounded like 20 during a contest.

There was the President of the Belgian national amateur radio society, U.B.A. (Union Belge Amateur); to be received by our own President, GI3KYP, Barney Patterson, with a certain semblance of formality, if you can achieve formality when you share 120 square feet of space with 100 other people, all jabbering fit to blow a fuse and kissing each other on both cheeks, European-style.

Whatever their faults, the British are marvellous when it comes to formality. Their critics say they rely on pomp and circumstances rather too much, neglecting trivia like realism and efficiency. It happens that

those critics are usually the first to copy the British in everything they do!

The two Presidents shook hands, cameras flashed and a small boy who must have wandered into the hall by accident (he surely was unconnected with the Science of Amateur Radio) was heard, regrettably, to say:— “‘Oo are they, then? President Johnson ‘n Cosy-gin?”

Cosygin is basic English for *you-know-who*. But what that very disrespectful small boy put into words was something the politicians might mull over. If President Johnson ‘n Cosygin could meet in such an atmosphere of friendship and trust, we might yet get world reciprocal licensing.

Then there were the American V.I.P’s to cope with. They were easier to handle, speaking, as they did, a form of English. And *V.I.* they were! Last year, when the Duke of Edinburgh opened the Exhibition (See *Pussycat, Pussycat, Where Have You Been?*—January, 67, *CQ*) the A.R.R.L. President, W0NWX, Bob Denniston, came over specially for the occasion. He was presented to His Royal Highness and has never been the same since.

This year we were flattered to see that it was us, not the Duke, whom ARRL love. Dick Baldwin, W1IKE, Assistant General Manager, and Bob Booth, W3PS, ARRL Counsellor, had timed their European trips so that they could visit the Exhibition. So did the very distinguished Bill Orr, W6SAI, whom my son, G3UML, wanted to meet the way I’d like to meet Frank Sinatra.

Even if we didn’t have the Duke of Edinburgh to make of the Opening a never-to-be-forgotten occasion, one feature was to make the 1967 Exhibition significant. The publication of the history of the Radio Society of Great Britain, by John Clarricoats, G6CL, was timed to coincide with the event, which is as good a piece of housekeeping as you could wish. Books are always good sellers at amateur radio meetings. In 1967 the R.S.G.B. Exhibition Bookstall took \$3,000 in four days’ trading, staffed only by volunteer salesmen, which isn’t bad going in a country where attempts to introduce Business Efficiency Courses into the curricula of the more *avant-garde* universities has been met with a mixture of horror, suspicion and amused tolerance.

The Radio Society of Great Britain had been pregnant with its “History” for years. The publication caused quite a stir—not that



W4VGS (right) with R.S.G.B. Treasurer, G3BVG, Norman Caws.

radio amateurs were pacing the Maternity Waiting Room all night, before the delivery, but because the advent of the book was another manifestation of the new, “with-it” Swingin’ R.S.G.B. Gone and unlamented is the dilettante atmosphere of the Society, where “amateur” referred not only to the type of radio practised. The publishing side of the organization is expanding briskly, to meet a growing demand, in a technological age, for first-class books on a subject which increases in interest and significance with every new development.

“*The World At Their Fingertips*,” it’s called, 300 pages of erudite scholarship, in two editions, hard cover and paperback, authoritatively written in impeccable English, full as an egg of facts, statistics, dates and so packed with names that at times it reads like a telephone directory. It had to be written and it’s bound to be a success, as interesting to American amateurs as it is to British.

If you are over 60, it’s a compelling wallow of nostalgia. If you are younger, it’s an indispensable reference book. But the excitement of the story penetrates the dry prose and the interminable name-dropping, the awe with which the author writes of the *Great Names*—the phrase is used frequently



John Graham, G3TR, who will be 1968 President of R.S.G.B., with the wife of OD5LX.



Roy Stevens, (left) G2BVN, with W6FD and his wife, Mr. & Mrs. Bill Johnston.



President of Union Belge Amateur (right) greets VE6ASL.



GM's really do wear the kilt! This is GM5NN.

—of amateur radio's early days. You can comb out some very surprising and thought-provoking facts. There were the preposterous regulations which failed to inhibit British radio amateurs, despite the efforts of British officialdom; the academic distinction of some of the characters, the tenacity and single-mindedness of others; the very peculiar goings-on regarding the foundation of I.A.R.U., the discovery that what we do nowadays, that we think so revolutionary and sensational, like Conventions and Posh Dinners and regular Dinner Clubs, had all been done before, in the early 1920's. In 1924, for example, on 182.5 meters, a mobile station operated on a London-Edinburgh express train! And there's the fascinating story of the first Transatlantic reception, then of the first 2-way Transatlantic operation, which transcends the welter of technicalities and callsigns with something of the thrill those marvellous pioneers must have experienced.

This preoccupation with names, this obsession with reminiscence and regret for the Good Old Days, crops up the moment Old Timers begin to talk of amateur radio. Newcomers to the hobby complain that it is irritating and restricting and unproductive. Those brash youngsters should think again or, perhaps, *start* to think. It's easy for those of us who weren't even born in the early 1920's, to say, with the Prophet Joel:—

"Your old men shall dream dreams; your young men shall see visions." Those Senior Citizens who will revel in the lovingly recorded minutiae of this fine book, because it represents the story of their own youth, were once the young men who saw visions. Without those visions, that they dream about now, there would be no amateur radio for us to enjoy in 1967. And no R.S.G.B. Reception for Overseas Visitors!

At one time, when each year's new President was inaugurated, the ceremonial was followed by a solemn, prodigious "Presidential Address." The History tells us that, in 1925, when one of the most distinguished of the Presidents, the famous scientist, Sir Oliver Lodge, gave a discourse on the *"Radiation of Matter,"* it "must have been a source of wonderment and mystery than of enlightenment . . . to the majority of humble experimenters who made up the bulk of the membership . . ."

Since 1963 the Inauguration is part of an

informal social evening, which is always oversubscribed and to which as many women come as men, proof again, if the die-hards still demand proof, of the need that exists for amateur radio social functions. The remarkable success of this experiment led the Society to dare one step further. At the 1965 Exhibition a small reception was given for overseas visitors. This grew, like Topsy, until, in 1967, more than 100 people attended the party.

Everybody agreed it was a smashing party, and nobody more than W5IHP, Graham Hicks from Natchez, Miss. He wandered around with his portable tape recorder, into which we all spoke messages for the Boys Back Home. A party of 4X4's wished everybody a Happy New Year and Well Over the Fast, which was friendly of them—and why not? A Happy New York we all need, no matter if the New Year starts in October, 4X4-wise. As for the Fast—well, Ten is opening up at last after a 5-year Fast. W6FD, William Johnston, of Los Angeles, and his wife, expressed delighted surprise that the British could be so warm and kind. The A.R.R.L. Top Brass know us very well, and so they are used to our warmth and kindness.

The party might have been even bigger than it was. Just before it began a large group of American Servicemen, holding British reciprocal callsigns, arrived at the Exhibition. They would have liked to come, but they had arranged to go to the Playboy Club and there wasn't time for both dates. What the Playboy Club had to offer that R.S.G.B. didn't have we can't understand. What's a fluffy Bunny tail compared with the chance to meet and talk with VQ8, 9V1, PA0, ON4, ZB2, 9M2, OD5, 4X4, 9Q5 and 5Z4, as well as some of the nicest G's, W's, I's, DJ's and S.W.L.'s you could ever wish to meet?

After the party a group of us took the A.R.R.L. people out for dinner. We sorted some of their problems out for them and soon it was midnight and we had to get some sleep to gather strength for the 10 a.m. opening of the last, and most exhausting day of the Exhibition, next morning.

"So what do you think of R.S.G.B. now?" I asked Dick Baldwin. Since I've been an official of the Society, I'm as aggressively proud of it as if I were one of those Great Names in the History!

"Not bad, for a small club!" he replied. You can't win. ■



Graham Hicks, W5IHP, (left) with two AP0's.



The Visiting Firemen—in the photo are Dick Baldwin, W1IKE, Asst. Gen. Manager A.R.R.L., Bob Booth, W3PS, A.R.R.L. Counsellor, and W6SAI, Bill Orr. Mrs. Booth and Mrs. Orr are there too.



LX1DE, with Mrs. Maisie Jardine, wife of G5DJ, who is one of the "Hostesses" of the R.S.G.B. Welcome to London Program. That's her Badge of Office she's wearing.

CQ Reports on:

The Annual Radio-Electronic Convention For The Blind

BY ALAN M. DORHOFFER*, K2EEK

DURING October I got a call from a fellow journalist, Bob Gunderson, W2JIO, (*Braille Tech Press*) inviting *CQ* to participate in an annual Radio-Electronic Convention at the New York Institute For The Education Of The Blind. It wasn't going to be the large typical hamfest with lots of displays, and hundreds and thousands of hams milling around picking and poking at equipment, but rather a small select group, mainly students from different schools, whose qualification for attendance was that they are blind. At most hamfests or conventions there are always a few blind operators among many sighted ones but here the reverse would be true. We the sighted would be in the minority.

A common phenomenon occurs when sighted people are confronted with blind people, whereby the sighted individual begins to strain his intellect and vocabulary in order to avoid any mention of the word blindness. A sort of little mind game is played where substitutes for colors, hand signals, and other visual clues are found. An all out effort is made to keep the blind individual from feeling embarrassed when all along it's the sighted person who is flustered and embarrassed from the moment he reaches out to shake hands. Blind people know they're blind, and as soon as sighted people accept that fact things can get down to being normal again.

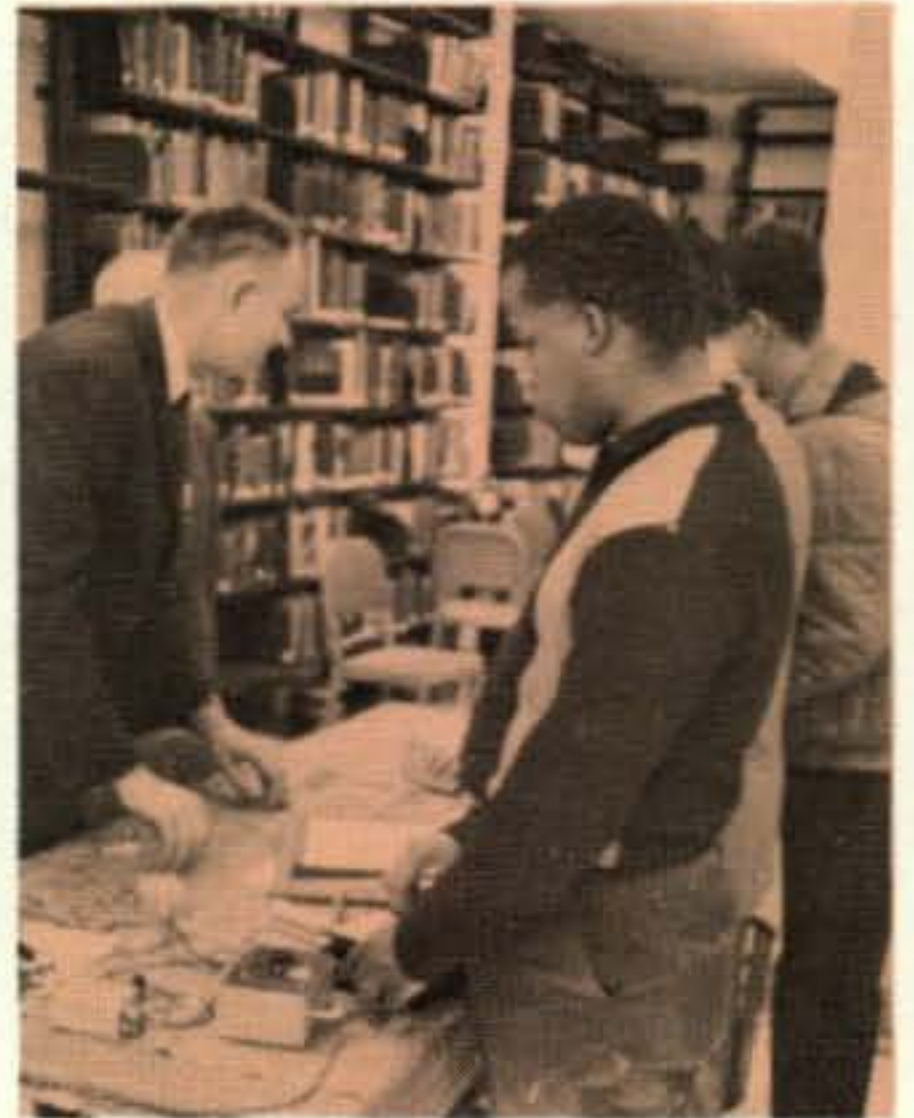
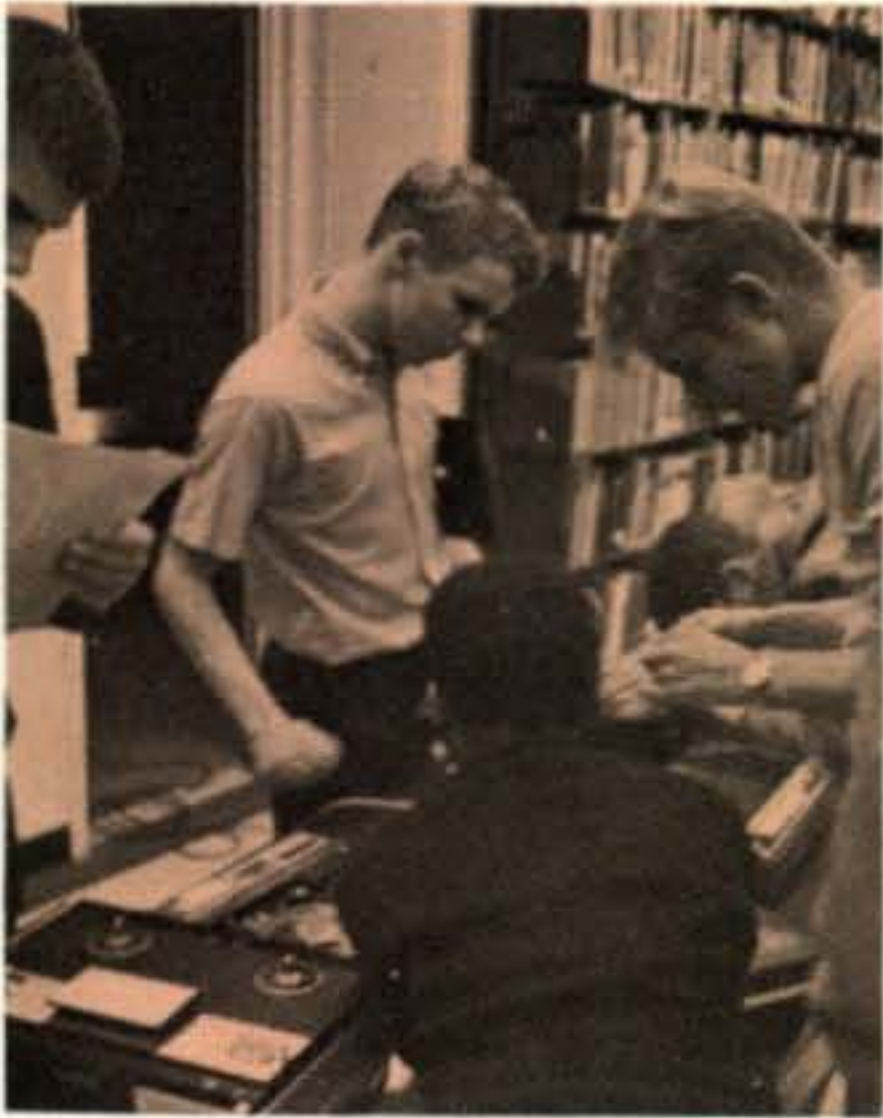
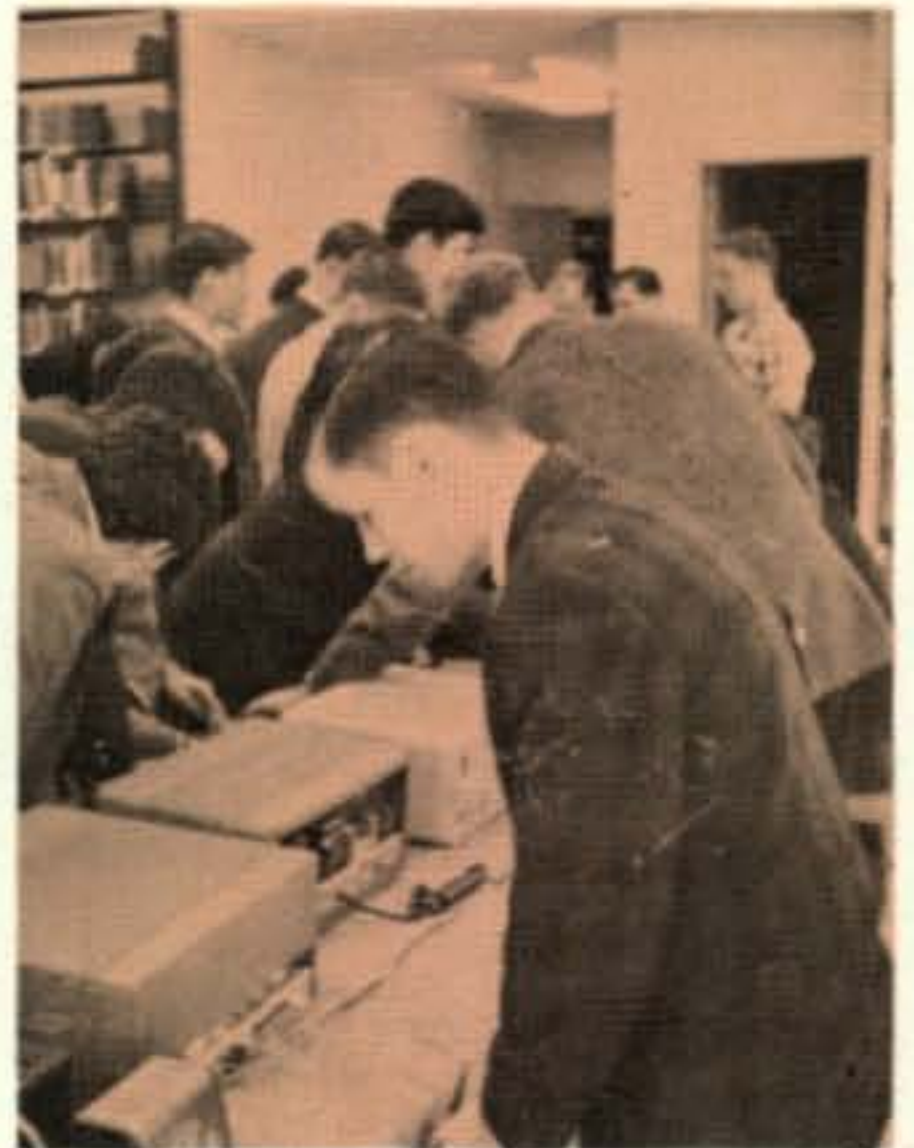
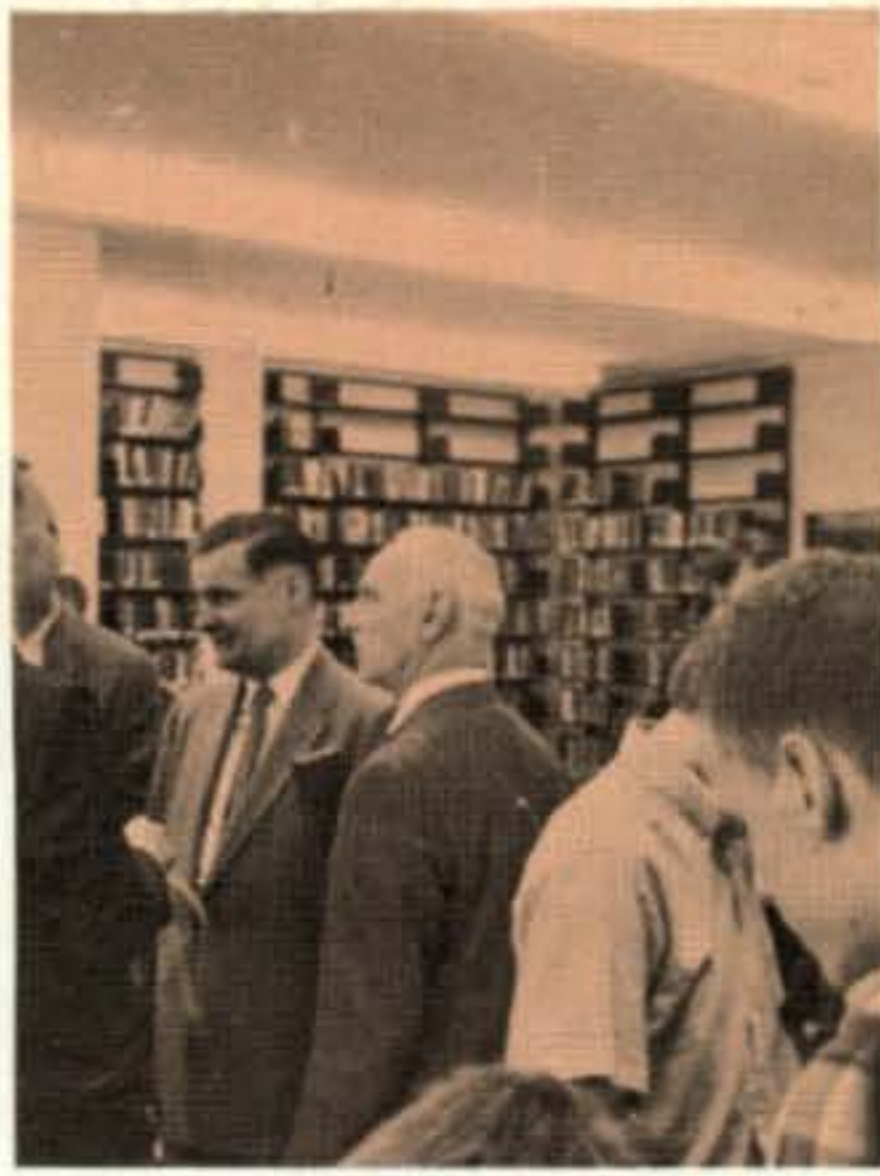
The convention started Friday evening, October 20, with a dinner followed by formal greetings and a panel discussion on teaching electronics and other sciences. Saturday, after an early breakfast, a lecture was given in the school's auditorium on

micro-wave communications and the Laser by a representative of the New York Telephone Company. This was followed by an open display area set up in the library. Various pieces of commercial equipment were shown through the courtesy of Grand Central Radio and Harrison Electronics, two New York distributors. Many other displays of test equipment designed by the blind for the blind were picked at and poked at in the same manner as other shows. The same questions were asked, the same comments were made and in general it was like many other shows.

After lunch, several speakers pointed out the significant difference in this convention of hams and enthusiasts from others. Joe Giovanelli spoke on basic teletype equipment and the advances and design of braille teletype equipment. Joe, a graduate of the Institute, explained a 200 diode device he was working on that would convert the 5 unit code of RTTY into the 6 unit code of braille characters and print out. Jim Swail of the National Research Council of Canada (similar to the U.S. Bureau of Standards) then spoke on auditory measuring instruments. Jim prefaced his remarks with a short history on how he became an engineer despite his blindness. The point of his talk was that any piece of test equipment used by sighted people can be adapted and used by blind people. Jim's job with the Research Council is in the development of such equipment. If you've suddenly thought of how can a blind technician or engineer read a scope pattern, forget it. Jim explained that a particular chart recorder available in most well equipped labs will reproduce scope patterns

[Continued on page 108]

* Managing Editor, *CQ*.



Everyone had a good time at the convention, which is really what Conventions are for.

Why, In The Middle Of Winter, You Should Put Up A New Quad

Three months ago we introduced a radical departure in Quad design. Whereas other Quads use booms and separate feed lines, and provide means for adjustment of traps or baluns or frequency, our new Regnair Model 321 Quad goes together in one hour, has no adjustments of any kind, and uses but a single feed line, with absolutely guaranteed results concerning VSWR, and the fact that there will be no interaction between bands. This is a combination that the ham fraternity has been looking for, and what's more, the price is right.

Because the Quad uses a boomless hub—some people refer to it as a spider—this Quad assembles in a different mechanical configuration. Actually, a 3½ inch diameter thick wall aluminum tube, 8 inches long, constitutes the center, or spider, of this Quad. Two aluminum tubes are inserted diagonally at each end of this thick wall tubing, and into these tubes are inserted the hardwood dowels, on which are fastened the pre-assembled Quad elements. The completed design provides for two elements, three bands, and one feed line. VSWR is absolutely guaranteed to be less than 1½ to 1 across the entire frequency on each of these three bands. This is accomplished in the final electrical design by using constant, electrical spacing on each band, and by the use of the 10 meter, quarter wave section inserted in the 20 meter element.

It is not necessary to use a Balun with this Quad, nor is a Balun recommended. All that you need do is connect up a piece of RG8 coaxial cable, in good condition, to the

end of the RG11 which is fastened at the feed point on the Quad. In other words, you get 7½ feet of RG11 which transfers the 100 ohm natural impedance of each of the driven elements down to 50 ohms on the RG8.

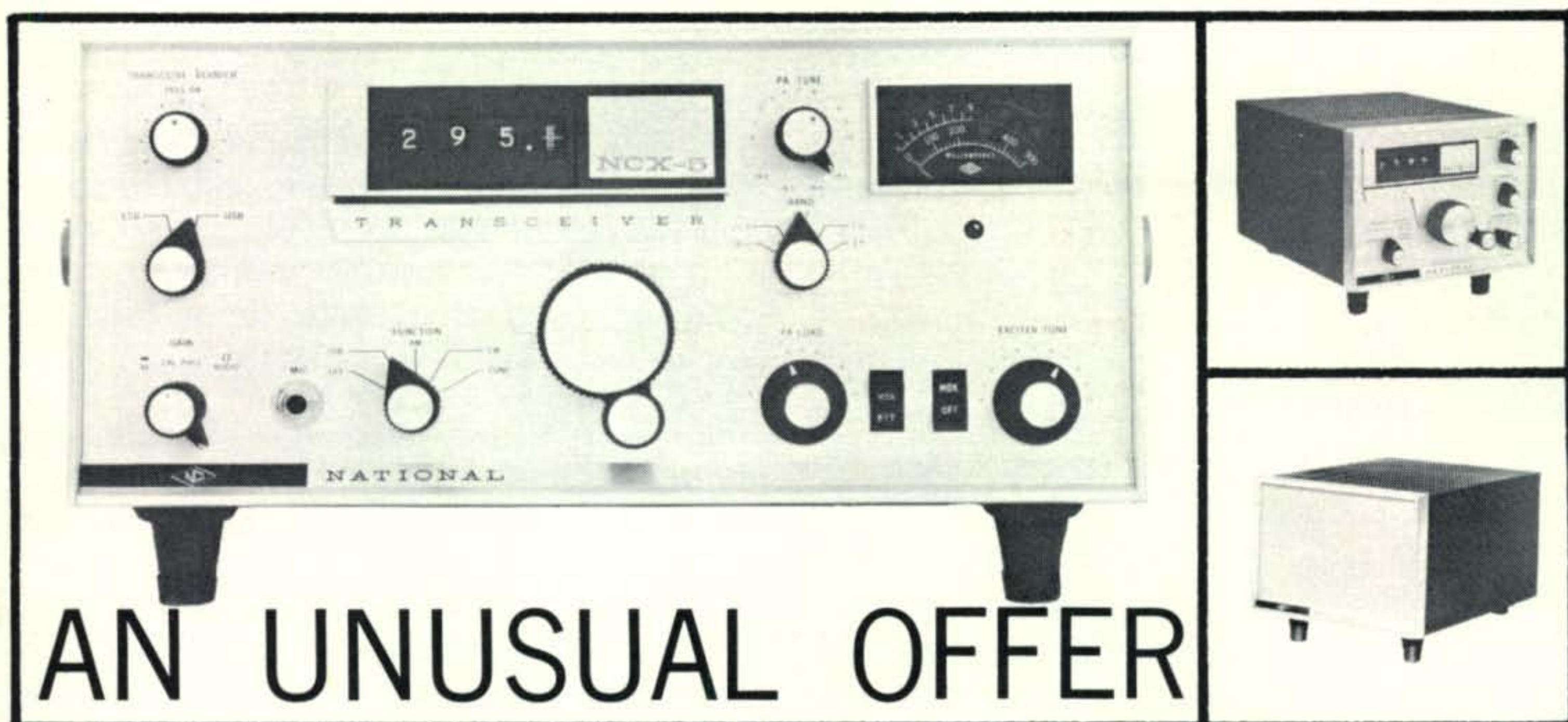
Considerable evidence as to the ability of this Quad to withstand the rigors of winter weather and hard blows have been provided by many, many customers over many years. Recently we have had a chance to sell this Quad on an exclusive basis. The result of our advertisements have been to place many score of these Quads in the hands of discriminating hams. When some of these hams, voluntarily take the time and trouble to write us or telephone us, describing the sheer pleasure of the results they obtain, we know we have a good item. The Quad is designed for 100 mile per hour winds, and half-inch radial ice. The outside dimensions are 18 feet by 18 feet by 12 feet. The turning radius is 10 feet. The net weight is 35 pounds. The maximum wind resistance is 4½ square feet. Even a small AR22 TV rotator will handle this Quad. The Quad provides 8 db of gain over a dipole, and better than 25 db front-to-back ratio on each of the three bands involved. Please remember that this is a full-size Quad. There are no loading coils, no stubs to tune, no adjustments and each of the elements—that is, the driven element and the reflector—are pre-tuned and pre-cut at the factory. All you have to do is follow the instructions provided therein and go to town on lots of DX that exists these days.

HERBERT W. GORDON COMPANY

Woodchuck Hill Road, Harvard, Mass. 01451

"Helping Hams to Help Themselves"

New Readers Service on Page 120



AN UNUSUAL OFFER

Hams visiting me are invariable impressed when I demonstrate my station. It consists of a National NCX-5 with a BTI Linear. The results are pure pleasure. Just about every station called is worked—no matter when they are located. Obviously my antenna system has a great deal to do with my results, but whereas I have a choice of all transceivers, why do I use the National NCX-5?

In a few words—because I like its performance, its conveniently thought-out controls, its greater flexibility and ease of operation—especially in contests or when the going gets rough.

When your signal is the dominant one—and when the DX is vying with each other to try to work you—they haven't the time and sometimes the means, to exactly zero beat you. Maybe they are only 100 cycles away, or perhaps it's 2 KC from where you are transmitting. With most transceivers you would be lost as far as these contacts are concerned, for you wouldn't want to constantly change your transmitted frequency. The NCX-5 has incremental tuning which permits up to plus or minus 5 KC of vernier tuning.

Next in importance to me is the ability to read frequency precisely, and to an order of 100 cycles. In most products, you only guess at up to ± 3 KC.

Did you ever handle traffic? Notice how

often it is necessary to go on the opposite sideband for copy, while the Net continues along. The NCX-5 provides opposite sideband operation.

For round-table SSB work, Vox is most useful. Does your transceiver offer Vox? The National NCX-5 does—and it's a darned good one, too.

Suppose you want to operate CW. Do you have to switch your transceiver every time you listen or every time you send. The National NCX-5 offers automatic break-in CW. To my knowledge, it's the only set that does this.

I could go on and on. Suffice it for me to say that this model set has been debugged, is very, very practical for me to use—and should therefore be for you, too.

Now here is the deal. I will sell you the latest Mark II version—factory fresh NCX-5 at \$549.00. Its matching console speaker and supply is \$110.00. A companion VFO with the same digital read-out sells for \$250.00. Add these up and they total 909 bucks. My special price for the three pieces—all with a 1 year guarantee—is but \$750.00, delivered free to the 48 states. The bargain applies to all three pieces; in effect you are saving \$150.00 on the companion VFO.

Here is the height of deluxe ham radio operation at a price you can afford. Terms to those deserving them—trade-ins, too.

HERBERT W. GORDON COMPANY

Woodchuck Hill Road, Harvard, Mass. 01451

"Helping Hams to Help Themselves"

New Readers Service on Page 120



DX

BY JOHN A. ATTAWAY,* K4IIF

IT'S hard to believe that another month has rolled around since I last wrote this column. However, judging from this long list of WPX, WAZ, and S.S.B. DX Award recipients the calendar is right as usual. The new winners are the following:

Mixed WPX: W8ROC—139, WB2CDZ—140, W1RLV—141, W2LWI—142, SP8AJK—143.

C.W. WPX: SM6CZU—791, W6BPO—792, K1QZV—793, K5VTA—794.

S.S.B. WPX: YV4QG—280, VE3EVU—281, HR1KAS—282, G3JEC—283, W8FPM—284, WB6CPE—285, W4BA—286.

WPX Endorsements: Mixed: W8ROC—550. C.W.: OK1SV—650, W0AUB—600, SP6FZ—500, K1QZV—350. S.S.B.: HR1KAS—300, VE3EVU—250, W4BA—250. Phone: W9UZC—600. Euope: W8ROC, SM6CZU, JA1BN. No. America: VE3UR. 14 Mc: W6CHY. 7 Mc: DL1YA. 1.8 Mc: DL1YA.

C.W.—Phone WAZ: JA2TH—2332, SP2AJO—2333, VE6AQL—2334, W8NPF—2335, YU3NEG—2336, SM5BBC—2337, K1DIR—2338, W8ROC—2339, DL6PI—2340, DJ1NS—2341, VE7SE—2342, 7X0AH—2343.

2 X S.S.B. WAZ: K6OHJ—469, W1CKA—470, K9EMG—471, OE3WWB—472, W2CKY—473, VK6XX—474, LA7JH—475.

Phone WAZ: K6OHJ—360, LU9DAH—361, W6CHY—362, DJ3QX—363, ZS4F—364, ZL1AQE—365.

S.S.B. DX Awards: 300 Countries: WA2RAU—18, W4SSU—19, K6CYG—20, W4PAA—21, I1AMU—22, W5KUC—23, W4OPM—24, KP4CL—25.

200 Countries: W4HA—138, OE7UD—139, WA8AJI—140, W8EVZ—141, K4GXO—142, K4IIF—143, VE6TP—144.

100 Countries: VE3ELA—494, OK1MP—495, W4BA—496.

DX Awards Program

Complete rules for the WPX and WAZ Awards were given in the August, 1967 issue. If you would like application blanks or reprints of the rules for these awards please send a self-addressed, stamped envelope to

* P.O. Box 205, Winter Haven, Fla. 33881.

DX Editor, P.O. Box 205, Winter Haven, Florida 33880. The S.S.B. DX Award Program is being reorganized, but certificates are still being issued for 100, 200, and 300 countries worked on 2 X S.S.B. We are presently using the ARRL DXCC country list and rules, however, a separate country list of our own is under consideration. Send an s.a.s.e. to the DX Editor for an application.

NOVICES: Who will be the first winner of the WPNX Award? WPNX is CQ's Award for Novices only and may be earned by working 100 different prefixes as a Novice. Contacts must be made after May 15, 1967. If you would like an application blank send a self-addressed, stamped envelope to the DX Editor at the above address.

160 Meter FLASH — Transpacific Tests

The first trans-Pacific 160 Meter DX Tests ever attempted are scheduled for the 1967-68 winter season. This is to be a cooperative effort between the JARL and prominent U.S. and Canadian 160 Meter enthusiasts. Dates of the tests are Dec. 2, Dec. 16, Dec. 30, Jan. 13, Feb. 3, and Feb. 17. Special efforts will be made to establish new distance records. Times are set to embrace sunrise on the U.S. Pacific Coast and are 1330-1600 GMT. Those Asian stations wishing to try for the North American east coast may start at 1130 GMT to coincide with Atlantic coast sunrise peak conditions. W/VE stations will call CQ DX Test the first 5 minutes of the hour or half-hour, and alternate periods thereafter—listening between times. Asian stations will call CQ DX Test the 2nd, 4th, and 6th, 5 minute periods and listen between times. W/VE west coast stations will use 1975-2000 kc, W/VE east coast stations 1800/1825 kc, JA stations 1907.5—1912.5 kc, and ZL/VK and other Asian stations 1800-1860 kc.

Anyone desiring further details should contact W1BB who advises that this is NOT a contest.

DE EXTRA

What Next! It's hard to believe that in this very column I once used the heading "Don Miller Crisis Ends." So I'm a poor prophet, but if I had told you last summer that before the year was out the renowned publisher of a well-known amateur magazine would be backing the boys from Newington I'm sure you would have thought me daft. However, it's come to pass as of this writing in early

October. Now this doesn't mean that this "meeting of minds" will still be making news when you read this in December, but for the moment it sure is. Don Miller doth produce strange bedfellows, or whats the fashionable color this season; award's committee green of course.

Really this is almost enough to make one feel sorry for Don. When the legal eagles of the league and the journalistic tactician of "Best Regards" are arrayed against you, what chance have you got? Not much if you're an ordinary man, but if you're Dr. Donald A. Miller, W9WNV, M.D. there may be quite a fight yet. You have to make Don the underdog, but when the Dr. fires a barrage of journalistic verbiage and unleashes his own legal department the "alliance" may end up buried so deep in paper that we'll never hear from them again. This poor column might then be the sole spokesman for the DX world. Heaven forbid!

Honestly guys and gals I'm not trying to be funny. I love amateur radio, particularly DX, and right now I feel like lying down on the floor and crying. It doesn't matter anymore who is right, Don may be the reprobate the alleged alliance thinks he is, or he may be the misunderstood hero his supporters think he is. We'll never know the whole truth. A Geneva conference couldn't unravel this one so we advocate a cooling off period. Don has conducted himself in such a manner that the charges against him are believable whether true or not. We suggest that Don come home and practice medicine for 4 or 5 years before his next DXpedition, and by then things will have cooled down enough to get this thing cleared up.

About QSL Managing

The following was written by Dr. John Allaway, G3FKM, in the RSGB Bulletin. Its worth reading.

"Nearly every correspondence column in Amateur Radio magazines contains some reference to that universal Aunt Sally, the QSL Manager. Most of the correspondents appear to be against rather than for, and it seems to the writer that a few facts gleaned from a letter from WA2RAU, who in a moment of indiscretion consented to act as QSL Manager for the recent VK2AVA/Lord Howe expedition, might be of interest to those who think that the task is a financially rewarding one! Apparently the total sum of money received with the first 3000 applications for QSLs was \$66.00—an average of just over 2¢ per QSL. Many applicants



Pat, F08BW(W6JFM), and XYL Marthe during a recent visit to their French Polynesia home. Using a KWM-2, Honda generator, and a dipole at 60 feet Pat made over 700 QSOs despite 2 weeks of constant rain and winds up to 70 knots.

were too mean to even enclose an addressed envelope, and WA2RAU finished his thankless task showing a loss of over \$100.00. Just how mean some of our fraternity are is illustrated by the instance of one individual who sent a 10¢ coin with a note which read: 'Enclosed is 10¢, 8¢ for postage and 2¢ for your pay as QSL Manager, that's all I believe QSL Managers are worth.'

"What is very clear is that in a good many instances there would be no QSL cards at all sent out by some of the rarer stations unless some kind person went out of his way to arrange for QSLs to be printed (often at his own expense), and to undertake the not inconsiderable chore of filling them in and mailing them. It should be remembered that the services of a free QSL bureau for outgoing cards is not available in many countries, including the United States, and that cards have therefore to be mailed at considerable expense. Surely it is not too much to extend the courtesy of an addressed envelope and return postage when taking advantage of someone else's generosity." (Well said!—K4IIF)

New Countries of the World

If you're having a hard time keeping your



Cherici Armando, 111Z — This top Italian DXer recently qualified for both the WAZ and WPX Awards.

Country	Prefix	Date of Indep.	Country	Prefix	Date of Indep.	Country	Prefix	Date of Indep.
Algeria	7X	Jul 5, 1962	Indonesia	8F	Dec 28, 1949	Nigeria	5N2	Oct 1, 1960
Barbados	VP6	Nov 30, 1966	Israel	4X	May 15, 1948	Pakistan	AP	Aug 14, 1947
Botswana	ZS9	Sep 30, 1966	Ivory Coast	TU2	Aug 7, 1960	Philippines ..	DU	Jul 4, 1946
Burma	XZ2	Jan 4, 1948	Jamaica	6Y5	Aug 6, 1962	Rwanda	9X5	Jul 1, 1962
Burundi	9U5	Jul 1, 1962	Jordan	JY	Mar 22, 1946	Senegal	6W8	Aug 20, 1960
Cambodia	XU	Nov 8, 1949	Kenya	5Z4	Dec 12, 1963	Sierra Leone	9L1	Apr 27, 1961
Cameroon	TJ	Jan 1, 1960	Korea HM, HL	9	Aug 15, 1948	Singapore	9V1	Aug 9, 1965
Cent. Afr. Rep.	TL8	Aug 13, 1960	Kuwait	9K2	Jun 19, 1961	Somalia	60	Jul 1, 1960
Ceylon	4S7	Feb 4, 1948	Laos	XW8	Jun 19, 1949	Sudan	ST	Jan 1, 1956
Chad	TT8	Aug 11, 1960	Lebanon	OD5	Nov 22, 1943	Syria	YK	Jan 1, 1944
Congo	TN8	Aug 15, 1960	Lesotho	7P	Oct 4, 1966	Tanzania	5H3	Dec 9, 1961
Congo	9Q5	Jun 30, 1960	Libya	5A	Dec 24, 1951	Togo	5V	Apr 27, 1960
Cyprus	5B4	Aug 16, 1960	Madagascar	5R8	Jun 27, 1960	Trinidad & Tobago	9Y4	Aug 31, 1962
Dahomey	TY	Aug 1, 1960	Malawi	7Q7	Jul 6, 1964	Tunisia	3V8	Mar 20, 1956
Gabon	TR8	Aug 17, 1960	Malaysia	9M2	Aug 31, 1957	Uganda	5X5	Oct 9, 1962
Gambia	ZD3	Feb 18, 1965	Maldives Islands	VS9M	Jul 26, 1965	Upper Volta	XT2	Aug 5, 1960
Ghana	9G1	Mar 6, 1957	Mali	TZ	Sep 22, 1960	Viet-Nam	3W8	Mar 8, 1949
Guinea	7G1	Oct 2, 1958	Malta	9H1	Sep 21, 1964	Western Samoa	5W1	Jan 1, 1962
Guyana	4U2	May 26, 1966	Mauritania ..	5T5	Nov 28, 1960	Zambia	9J	Oct 24, 1964
Iceland	TF	Jun 17, 1944	Morocco	CN	Mar 2, 1956			
India	VU	Aug 15, 1947	Niger	5U7	Aug 3, 1960			

country totals straight there's a good reason. Since 1943, 61 newly independent states have been formed. The above list showing the new countries and the dates of their independence is courtesy Dr. Larry E. Price, W4DQD, Associate Professor of Finance at Georgia Southern College.

The QSL Bureaus — Part II

In the November column we considered the addresses and function of the A.R.R.L. QSL Bureaus which handle incoming QSL cards for U.S. and Canadian amateurs. This month we have the addresses of the overseas Bureaus. These are the locations to which you send your QSLs when you do not have a direct address, or when you have several cards for one country and wish to send them by the most economical means. QSLing via the bureau is obviously slower than going



Some of the VS6, Hong Kong gang living it up on club meeting night. Left to right VS6FS, VS6FO, VS6EN, VS6AJ, and VS6EK.

via the direct route. However, it is frequently the only route, and DXers everywhere owe a debt of gratitude to the devoted amateurs who operate the bureaus. I know of no bureau which receives any compensation at all for the great amount of time invested.

Country	Address of QSL Bureau
Aden	Amateur Radio Club, RAF Khor-maksar, B.E.P.O. 69, London, England.
Algeria	G. Deville, 7X2RW, 21 Blvd. Victor Hugo, Alger
Angola	L.A.R.A., P.O. Box 484, Luanda
Antarctica	KC4AA—cards via Office of Antarctic Programs, National Science Foundation, Washington 25, D.C.
Argentina	KC4US—cards go to K1NAP
Australia	R.C.A., Carlos Calvo 1424, Buenos Aires, BA.
Austria	W.I.A., 23 Landale St., Box Hill, E. 11, Victoria
Azores Islands	Oe. V.S.V., Box 999, Vienna 1/9
Bahama Islands	Via Portuguese Bureau, R.E.P., Rua de D. Pedro V., 7-4°, Lisbon
Bahrein (All MP4)	Bahama Amateur Radio Society, Box 913, Nassau
Barbados	Ian Cable, MP4BBW, P.O. Box 425, Awali
Belgium	Amateur Radio Society, Highgate Signal Station, Flagstaff road, St. Michael
Bermuda	U.B.A., P.O. Box 634, Brussels 1
Bolivia	R.S.B., P.O. Box 275, Hamilton
Brazil	R.C.B., Casilla 2111, La Paz
British Guiana	L.A.B.R.E., Caixa Postal 2353, Rio de Janeiro
Bulgaria	see Guyana
Burma	P.O. Box 830, Sofia
Burundi	B.A.R.T.S., P.O. Box 800, Rangoon
Canal Zone	Via the Congo (9Q5) bureau
	To KZ5RV, P.O. Box 407, Balboa

Cape Verde Islands	Radio Club de Cabo Verde, Praia, Sao Tiago	Guyana	D.E. Yong, 4U2YG, Box 325, Georgetown, Demerara
Cayman Islands	Via Jamaica bureau	Haiti	Radio Club d'Haiti, Box 943, Port au Prince
Ceylon	4S7WP, P.O. Box 907, Colombo	Honduras	Jacobo Zelaya, Jr., HR1JZ, 13 Calle 505, Tegucigalpa, D.C.
Chagos	To Mauritius bureau	Hong Kong	Hong Kong Amateur Radio Soc., P.O. Box 541
Chile	Radio Club de Chile, P.O. Box 13630, Santiago	Hungary	H.S.R.L., P.O. Box 214, Budapest 5
Columbia	L.C.R.A., P.O. Box 584, Bogota	Iceland	Islenzkir Radio Amatoar, Box 1058, Reykjavik
Congo (TN8)	QSL Bureau, P.O. Box 2239 Brazzaville	India	A.R.S.I., P.O. Box 534, New Delhi 1
Congo (9Q5)	U.C.A.R. QSL Bureau, B.P. 3748, Elisabethville	Iran	Amateur Radio Soc. of Iran, APO, N.Y. 09205
Cook Islands	ZK1 QSL Bureau, c/o Radio Station Rarotonga, Rarotonga	Ireland	I.R.T.S. Bureau, 24 Wicklow St., Dublin 2
Costa Rica	Radio Club of Costa Rica, Box 2412, San Jose	Ireland, Northern	To GI3HXV, 45 Erinvale Ave., Finaghy, Belfast 10
Cuba	ANRAC QSL Bureau, P.O. Box 6996, Havanna	Israel	I.A.R.C., P.O. Box 4099, Tel-Aviv
Cyprus	CARS QSL Bureau, Box 216, Famagusta	Italy	A.R.I., Viale Vittorio Veneto 12, Milano 401
Czechoslovakia	C.A.V., P.O. Box 69, Prague 1	Jamaica	J.A.R.A., 76 Arnold Road, Kingston 5
Denmark	E.D.R. QSL Bureau, OZ6HS, Ingstrup	Japan (JA)	J.A.R.L., Box 377, Tokyo
Dominican Republic	R.C.D., P.O. Box 1157, Santo Domingo	Japan (KA)	F.E.A.R.L., -M-, APO, San Francisco 96525
Ecuador	Guayaquil Radio Club, P.O. Box 5757, Guayaquil	Johnston Island	KJ6BZ, c/o MARS Station, Dept. 1, 1957 Comm. Gp., APO San Francisco 96305
El Salvador	QSL Bureau, P.O. Box 517, San Salvador	Kenya	To Jerry Plemmons, 5Z4KN, Voice of Kenya Radio, Nairobi
Ethiopia	Kagnew Amateur Radio Club, APO, New York 09843	Korea	K.A.R.L., Central Box 162, Seoul
Faeroes Islands	QSL Bureau, P.O. Box 184, Torshavn	Korea (HL9)	HL QSL Bureau, Signal Section, USFK/EUSA, APO, San Francisco 96301
Fiji Islands	P.O. Box 184, Suva	Kuwait	Alhaf Nasir K. Khan, 9K2AN, Box 736, Kuwait, Persian Gulf
Finland	S.R.A.L., Box 10306, Helsinki 10, Finland	Laos	Via XW8AL, P.O. Box 46, Vientiane
Formosa	BV1IS—to USARSCAT, Box 8, APO, San Francisco 96263	Lebanon	R.A.L. QSL Bureau, P.O. Box 1217, Beirut
France	Other BV to C.R.A., Box 2007, Keelung, Taiwan		
France (F7 only)	F7QSL Bureau, c/o Base MARS Station, APO, New York, N.Y. 09083		
France	R.E.F., B.P. 26, Versailles		
Germany (DL2)	DL2CT, Box 125A, B.F.P.O. 19, London, England		
Germany (DL4&5)	MARS Station, Hqtrs. 12th Signal Group, APO, N.Y. 09046		
Germany (West)	D.A.R.C., P.O. Box 99, 8 Munich 27		
Germany (East)	DM QSL Bureau, P.O. Box 30, Berlin 55, GDR		
Ghana	C/O 9G1CW, P.O. Box 3773, Accra		
Gibraltar	RAF Amateur Radio Club, New Camp, RAF		
Gilbert & Ellice Islands	To VR1A, P. & T. Dept., Betio, Tarawa		
Great Britain	R.S.G.B. QSL Bureau, G2MI, Bromley, Kent		
Greece	George Zarafis, P.O. Box 564, Athens		
Greece (SVØ only)	Signal Officer, Hqtrs. JUSMAGG, APO, N.Y. 09223		
Greenland	Via Danish Bureau		
Guam	M.A.R.C., Box 445, Agana (Zip 96910)		
Guantanamo Bay	Guantanamo Amateur Radio Club, Box 74, FPO, N.Y. 19593		
Guatemala	C.R.A.G., P.O. Box 115, Guatemala City		



Masakazo Yoke, JA3HVC, of Kyoto, Japan. "Masa" works all bands 80-10 meters and plans to get on 160 in the near future. (Photo courtesy W1BB)



This is Jim Lawson, WA2SFP, one of the best DX and Contest operators of all time. He was the first to qualify for the special contest WPX award, earning it by working 280 prefixes in the 1967 CQ WW S.S.B. Contest.

Liberia	L.R.A.A., P.O. Box 1477, Monrovia
Libya	5A QSL Service, Box 372, Tripoli (U.S. hams are no longer on the air from Libya)
Liechtenstein	To Swiss Bureau
Luxembourg	R. Schott, 35 rue Batty Weber, Esch sur/Alzette
Macao	Via Hong Kong Bureau
Madeira Islands	To Portuguese Bureau
Malagasy Republic	P.O. Box 587, Tanarive
Malawi	7Q7RM, P.O. Box 472, Blantyre
Malaya	QSL Manager, M.A.R.T.I.S., Box 777, Kuala Lumpur
Maldives Islands	Via Aden Bureau
Malta	R.F. Galea, 9H1E, "Casa Galea", Railway Road, Birkirkara
Mariana Islands	Via Guam Bureau
Marshall Islands	To KX6BU, Box 444, FPO, San Francisco 96555
Mauritius	Paul Caboche, VQ8AD, Box 467, Port Louis
Mexico	L.M.R.E., P.O. Box 907, Mexico, D.F.
Midway Island	KM6BI, Box 14, FPO, San Francisco 96643
Monaco	Pierre Anderhalt, 3A2CN, 49 rue Grimaldi



Roland, FO8BV (left), and Ray, FO8AQ (right) argue the relative merits of the quad and yagi while Nick, HB9VP (center) acts as mediator. (Photo courtesy W6JFM)

Mongolia	JT1KAA, Box 639, Ulan Bator
Morocco	A.A.E.M., R.O. Box 299, Rabat
Mozambique	L.R.E.M. QSL Bureau, P.O. Box 812, Laurencio Marques
Netherlands	V.E.R.O.N., P.O. Box 400, Rotterdam
Netherlands Antilles	V.E.R.O.N.A., P.O. Box 383, Willemstad, Curacao
New Zealand	N.Z.A.R.T., P.O. Box 489, Wellington
Nicaragua	C.R.E.N. QSL Bureau, P.O. Box 926, Managua
Nigeria	NARS QSL Bureau, Box 1044, Samaru, Zaria
Norway	N.R.R.L., P.O. Box 898, Oslo Sentrum, Oslo 1
Okinawa	O.A.R.C., APO, San Francisco, Calif. 96331
Pakistan, East	Mohd., AP5CP, Tiger Amateur Radio Club, Dacca Signals, Dacca 6
Pakistan, West	Ahmed Ebrahim, AP2AD, P.O. Box 65, Lahore
Panama	L.P.R.A., P.O. Box 1622, Panama City
Papua	VK9 QSL Officer, P.O. Box 204, Port Moresby
Paraguay	R.C.P., P.O. Box 512, Asuncion
Peru	R.C.P., Box 538, Lima
Philippine Islands	P.A.R.A. QSL Bureau, P.O. Box 4083, Manila
Poland	PZK QSL Bureau, P.O. Box 320, Warsaw
Portugal	R.E.P., Rua de D. Pedro V., 7-4°, Lisbon
Puerto Rico	KP4YT, P.O. Box 1061, San Juan, P.R. (Zip 00902)
Rhodesia	R.S.S.R., P.O. Box 2377, Salisbury
Roumania	Central Radio Club, P.O. Box 95, Bucharest
Rwanda	To Congo (9Q5) Bureau
Samoa	KS6AX, Comm. Officer, Gov't of American Samoa, Pago Pago 96920
Saudi Arabia	HZ1AB, 7244th ABRON-COMM., APO, N.Y. 09616
Scotland	Via G2MI, R.S.G.B. Bureau
Senegal	Ch. Tenot, 6W8BF, P.O. Box 871, Dakar
Sierra Leone	Radio Society, P.O. Box 907, Freetown
Singapore	QSL Manager, M.A.R.T.S., P.O. Box 777
Somali Republic	P.O. Box 397, Mogadiscio
South Africa	S.A.R.L., P.O. Box 3037, Cape-town
Spain	U.R.E., P.O. Box 220, Madrid
St. Vincent	QSL Bureau, P.O. Box 142, St. Vincent, West Indies
Surinam	QSL Manager, S.A.R.L., P.O. Box 240, Paramaribo
Sweden	Sveriges Sandara Amatorer, FACK, Enskede 7
Switzerland	U.S.K.A., 6233 Buron/LU
Syria	P.O. Box 35, Damascus
Tanzania	R.S.E.A., P.O. Box 2387, Dar es Salaam
Trinidad & Tobago	9Y4LT, Box 1167, Port of Spain, Trinidad

[Continued on page 110]



Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Oct. 31—	Dec. 31	Zaragoza Spring Festival
December	2-3	VU2/4S7 C.W. Contest
December	2-3	Alexander Volta RTTY
December	9-10	9Q5 DX Contest
December	15-17	West Virginia QSO Party
January	6-8	Arkansas QSO Party
January	27-28	CQ WW 160 DX Contest
January	27-28	Louisiana QSO Party
February	3-4	ARRL DX Phone Contest
February	17-18	ARRL DX C.W. Contest
February	23-25	QCWA QSO Party
February	24-25	YL-OM Phone Contest
March	2-3	ARRL DX Phone Contest
March	16-17	ARRL DX C.W. Contest
March	9-10	YL-OM C.W. Contest
April	6-7	CQ WPX Phone Contest
April	20-21	Helvetia 22 Contest

Zaragoza Spring Festival

This announcement was received much too late to give it proper coverage. There is still some time left to enter the competition, it ends at 2400 GMT on December 31st.

This activity was organized in connection with the II International Convention of Radio Amateurs, Zaragoza, Spain during May 1968.

A Diploma will be awarded to any amateur who works at least one station in Zaragoza and 30 countries between Oct. 31—Dec. 31, 1967.

In addition the amateur submitting the highest country total for the above period will receive a free travel grant and accommodations for a stay in Zaragoza during the Convention.

Proof of contacts in the forms of QSLs must be received before March 1, 1968 by the Delegacion URE, Apartado 86, Zaragoza, Spain.

A service charge of \$1.00 may be paid in U.S. currency or 10 IRCs.

VU2/4S7 DX C.W. Contest

Starts: 0600 GMT Saturday, December 2

Ends: 0600 GMT Sunday, December 3

Rules for this one were covered in last month's CALENDAR. The phone section has already taken place.

Mailing deadline for both logs is December 31 to: Glen V. Wickremaratne, 4S7GV, 150/5 Kandy Road, Kurunegala, Ceylon.

Alexander Volta RTTY Contest

Starts: 1400 GMT Saturday, December 2

Ends: 2000 GMT Sunday, December 3

Rules and the Exchange Point Table, an important item in this contest were covered in last month's CALENDAR.

Logs go to: The SSB & RTTY Club, P.O. BOX 144, Como, Italy. Mailing deadline is December 24, 1967.

9Q5 DX Contest

Starts: 0100 GMT Saturday, December 9

Ends: 2200 GMT Sunday, December 10

The QSO point value is variable for different bands. Check last month's CALENDAR.

Logs go to: Contest Manager U.C.R.A., Post Box 1459, Kinshasa, Dem. Rep. of Congo and must be received before March 15, 1968.

West Virginia QSO PARTY

Starts: 0000 GMT Saturday, December 16

Ends: 2400 GMT Sunday, December 17

The Kanawha Radio Club is once again sponsoring this QSO party.

The same station may be worked once on each band and each mode, but interstate contacts are not permitted.

Exchange: QSO nr., RS/RST and QTH; county for West Va. stations, ARRL section or country for all others.

Scoring: West Va. stations, total QSOs multiplied by ARRL sections and countries worked. All others, QSOs multiplied by West Virginia counties worked. (max. of 55)

* 14 Sherwood Road, Stamford, Conn. 06905.



Part of the crew of club station UAØKFG, Sakhalin Island, Zone 19. (That's right, Zone 19, no longer Zone 25. The DX Committee has made all of Sakhalin in Zone 19. A good decision, this will avoid a lot of confusion. See page 94, July '67 CQ.) L. to R.—UWØFM Toly, UWØFK Slawa, and UAØER Ed.

Frequencies: 3570, 3890, 3903, 7050, 7205, 14050, 14300, 21050, 21410, 28050, 28800, 50250.

Awards: Certificates to highest scoring phone and c.w. station in West Virginia and each ARRL section and country.

A summary sheet showing scoring and name and address in BLOCK LETTERS is also requested.

Mailing deadline is January 15th and logs go to: West Virginia QSO Party, c/o Don Thompson, WA8YNT, Route 1, Box 376, Hurricane, West Va. 25526.

Arkansas QSO Party

Starts: 2200 GMT Saturday, January 6

Ends: 0400 GMT Monday, January 8

This is the 3rd annual party sponsored by the North Arkansas A.R.S.

The same station may be worked once on each band and mode.

Exchange: QSO Nr., RS/RST and QTH; county for Ark. stations; state, Canadian provinces or country for others.

Scoring: Ark. stations: 1 point per contact, multiplied by states, provinces and countries worked. Others: 5 points for each Ark. QSO multiplied by number of Ark. counties worked. (Max. of 75)

Frequencies: c.w.—3525, 7025, 14025, 21025, 28025. a.m.—3825, 7225, 14225, 28560, s.s.b.—3975, 7275, 14325, 21425, 28650. Novices—3735, 7175, 21110.

Awards: Certificates to the top scoring station in each state, Canadian province and foreign country. (Min. of 100 points)

Mailing deadline is January 30th. Logs go to: North Arkansas ARS, c/o Sam Housley, K5AKS, Route 4, Harrison, Ark. 72601.

Louisiana QSO Party

Starts: 1800 GMT Saturday, January 27

Ends: 2200 GMT Sunday, January 28

This is the third annual party sponsored by the Lafayette A.R.C. More participation would probably be assured if it did not conflict with the 160 meter contest.

The same station can be worked on each band and mode for QSO points.

Exchange: QSO nr., RS/RST and QTH; parish for La. stations, state, province or country for all others.

Scoring: Each QSO counts 1 point, including contacts between La. stations. The of states, Canadian provinces and countries multiplier for Louisiana stations is the sum worked. Out of state stations will use total Louisiana parishes worked. (max. of 64)

Frequencies: 3600, 3910, 7075, 7260, 14075, 14300, 21075, 21400, 28100, 28700.

Awards: Certificates to the 1st, 2nd and 3rd place winners in Louisiana. And the top scores in each state, VE call area and each country. (Min. score of 50 points)

Mailing deadline for logs February 29, and they go to: Lafayette A.R.C., 308 Karen Drive, Lafayette, Louisiana 70501. Include a s.a.s.e. if you want the results.

CQ WW 160 DX Contest

Starts: 0000 GMT Saturday, January 27

7 P.M. EST Friday, January 26

Ends: 1500 GMT Sunday, January 28

10 A.M. EST Sunday, January 28

One small change this year, the ending time of contest has been extended 3 hours in order to give the West Coast fellows a break, rest of us will be sleeping it off.

Rules same as previous years.

1. This is a c.w. contest *only*. No c.w. to phone or cross band contacts allowed.

2. For W/VE/VO stations: Contacts with other W/VE/VO stations, 2 points, Contacts with all other countries, 10 points.

3. For all other countries: 2 points per QSO with stations in the same country, 5 points with stations in other countries. Except for contacts with W/VE/VO stations, 10 points.

4. For all stations: A multiplier of 1 for each state, Canadian province or foreign country worked.

5. Final score: Total QSO points multiplied by the total multiplier.

6. Exchange: Six figures, RST plus a 3 figure progressive contact number starting

with 001 for the first contact, followed by your state or province. (Its not necessary for DX stations to send their country.)

7. Disqualifications: Violation of the rules and regulations for amateur radio in the country of the contestant, or the rules of this contest, or unsportsmanship conduct, or taking credit for duplicate contacts in excess of 3% of the total made, will be deemed sufficient cause for disqualification.

8. Awards: Certificates to the top scoring stations in each State, Canadian province and foreign country. 2nd and 3rd place awards will be given if participation warrants.

Hawaii and Alaska will be considered as "foreign countries" for QSO and multiplier credit. The District of Columbia counts same as Maryland. And don't forget, VE1 is divided into three provinces, Nova Scotia, New Brunswick and Prince Edward Is. And VE8 has two provinces, North West Territory and Yukon.

Log sheets and United States Operating Regulations for 160 may be obtained from CQ upon request. A large s.a.s.e. please.

Mailing deadline for your logs is Feb. 29th and they go to: CQ 160 Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050.

Editor's Notes

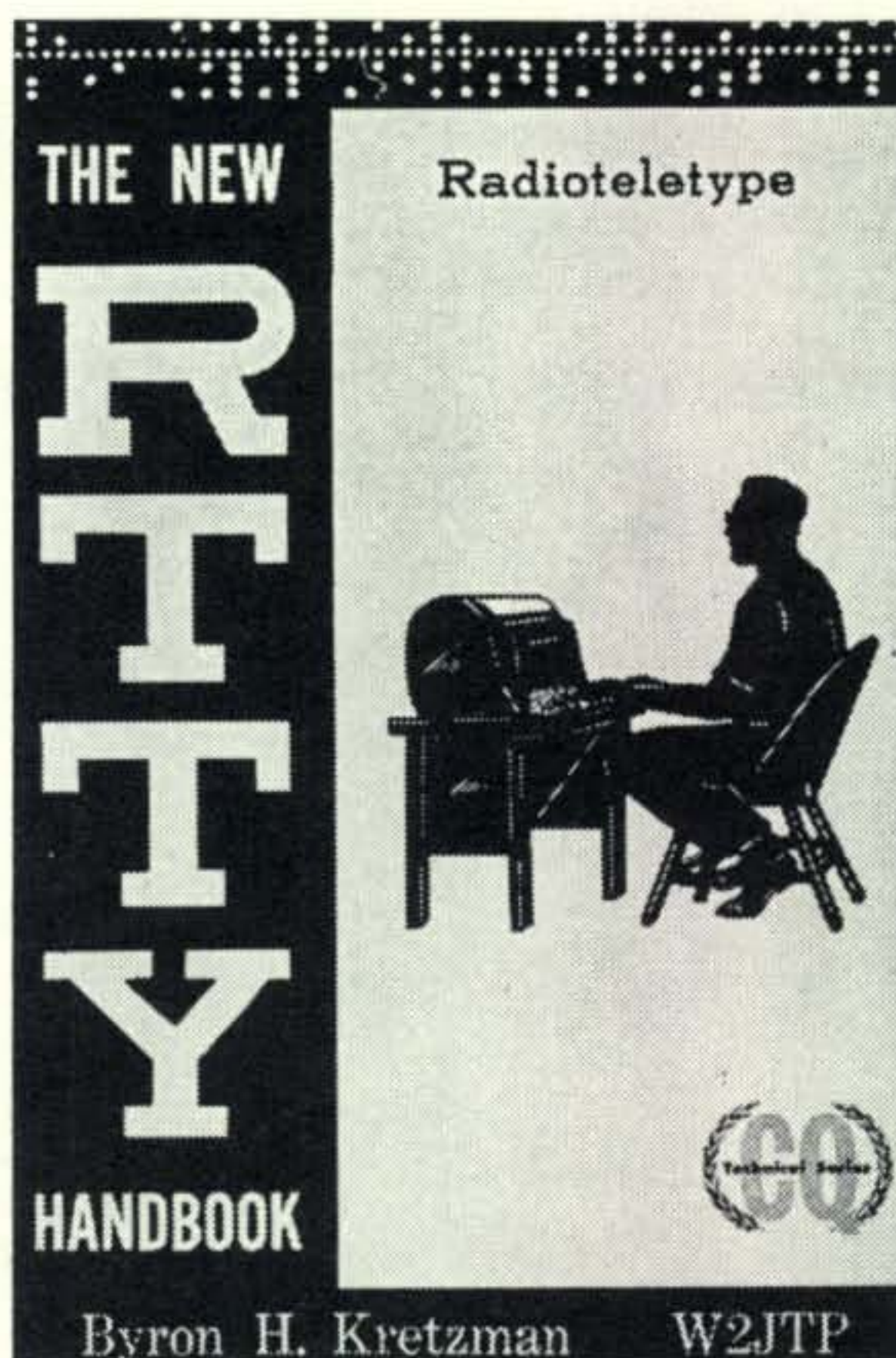
Again its my sad duty to mention another "Silent Key." Earl Lucas, W2JT a stalwart member of the North Jersey DX Association, a pioneer DX and contest man and my personal friend for over 30 years. Earl succumbed to a heart attack on September 29th. "May he rest in Peace."

Received a nice long letter from Charlie Rogers, W2AIW, describing all the exotic places he and his ex-YL visited on a 3 month trip around the world. The calls of some of the fellows he met would look good in any DX log. "Welcome back Charlie."

It's all over except for the "wait until next year" alibies. Over for you but just beginning for us. It seems only a few weeks ago that we put the last one to bed. Phone logs should have already been sent in and you should be preparing your c.w. entry. Nice clean and accurate logs and summary sheets please. We grow weary trying to decipher some of the hieroglyphics we receive annually. Have a very Happy Christmas holiday and all the best for the coming year.

73 for now, Frank, W1WI

"THE NEW RTTY HANDBOOK"



A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, operating procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section on getting started, all written by Byron Kretzman, W2JTP, a well known authority in the field. This book is a must for your library! Only \$3.95.

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CQ Magazine

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SIRS: My check (money order) for \$_____ is enclosed. Please send _____ copies of the "The New RTTY Handbook."

Name_____

Address_____

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Propagation

BY GEORGE JACOBS,* W3ASK

DURING December and January, propagation conditions in the high frequency amateur bands between the United States and Europe, the Far East, Central America and parts of Africa are expected to remain at about the same level as during October and November. Conditions on paths between the USA and central and southern Africa, South America, Oceania and parts of south and southeast Asia are expected to decrease slightly as a result of seasonal changes within the ionosphere.

Good-to-excellent openings are forecast to most areas of the world on 10 meters from shortly after sunrise through the late afternoon hours. Excellent openings are also expected on 15 meters from shortly after sunrise through the late afternoon and early evening hours. During most of the daylight hours it will be a toss-up between 10 and 15 meters for DX propagation honors.

Good-to-excellent DX propagation conditions are also forecast for 20 meters. The band should open at sunrise, and remain open to one area of the world or another through the daylight hours and into the early evening. To some areas of the world, 20 meters may remain open during the hours of darkness as well. Optimum DX conditions generally occur on this band during the sunrise period and again during the late afternoon and early evening hours.

DX propagation conditions to most areas of the world on the lower frequency bands are generally optimum during the winter months. During December, static levels on these bands should be at seasonally low values and signal levels are expected to be stronger than during other seasons of the year. DX openings on 40 meters are forecast to begin during the late afternoon hours, and the band should remain open to

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for December

Days	Forecast Rating & Quality			
	(4)	(3)	(2)	(1)
Above Normal: 1, 10, 15, 18, 20, 26, 28	A	A-B	B-C	C
Normal: 2-3, 5, 7-9, 11-12, 14, 16-17, 19, 21, 23, 25, 27, 29-30	A-B	B-C	C-D	D-E
Below Normal: 6, 13, 22, 24	C	C-D	D	E
Distributed: 4, 31	D	D-E	E	E

HOW TO USE THESE CHARTS

The following is an explanation of the symbols shown above, and instructions for the use of the CQ propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

3—With the forecast rating noted above, start with the numbers in parentheses at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meanings: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak with considerable fading and noise; E—poor opening, or none at all.

4—This month's DX Propagation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b., into a dipole antenna a quarter-wave above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

5—Local Standard Time for these predictions is based on the 24-hour system.

6—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9 and Ø areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid through Jan. 31, 1968, and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

one area of the world or another through the hours of darkness and until shortly after sunrise. Fairly good 80 meter DX openings to many areas of the world are forecast during the hours of darkness, and some 160 meter openings are likely to take place during the same period.

160 Meter Propagation Tests

With a seasonal improvement expected in

*11307 Clara Street, Silver Spring, Md. 20902.

DX propagation conditions on the 160 meter band, Stew Perry, W1BB, announces that this year's annual 160 meter propagation tests have been expanded. Since 1932, except for the war years, these tests have been held each year primarily across the trans-Atlantic path. This year, for the first time, tests will also be held across the Pacific to the Far East and Oceania.

The trans-Atlantic tests will be held this year on the following *Sunday* mornings between 0500 and 0730 GMT (12 Mid.-0230 A.M. EST):

December 3, 17 and 31st
January 14
February 4 and 18th

The trans-Pacific tests will be held on the following *Saturdays* between 1130 and 1600 GMT (0330 A.M.-08 A.M. PST):

December 2, 16 and 30th
January 13
February 3 and 17th

During the 1967-68 test, 160 meter stations are expected to be in operation in several dozen countries and on all continents. Special efforts will be made to establish new DX records for this band during the test periods.

W/VE stations participating in the tests should call "CQ-DX-TEST" the *first* five minutes of the hours, and on alternate (odd) periods thereafter, listening in between. DX stations should call "CQ-DX-TEST" during the *second* five-minute period, and alternate (even) five-minute periods thereafter, listening in between. Frequencies for the test period transmissions are as follows: Eastern W and VEs, 1800-1825 kc; Western W and VEs, 1975-2000 kc; Europeans, 1825-1830 kc; African stations, 1800-1825 kc; ZL and VKs, 1800-1860 kc; Japanese stations 1907.5-1912.5 kc.

These tests can be very exciting since many of the stations use very low power, on the order of a few watts. DX propagation takes place on the 160 meter band during the hours of darkness, or when one end of a circuit is in darkness and the other end is in twilight or dawn. W1BB emphasizes that these are test periods *not* contests. There is *no* competition and no scores are kept. The main purpose of the tests are to encourage the use of the 160 meter band, and

to develop propagation information throughout an entire solar cycle. Based on the unusually good trans-Atlantic 160 meter openings reported during the summer months, W1BB expects "hot" conditions on the "top band" during the 1967-68 test periods.

Reports of contacts made during the test periods as well as any other observations made on 160 meter reception or propagation conditions should be sent directly to W1BB at 36 Pleasant Street, Winthrop, Mass.

V.H.F. Ionospheric Openings

There is a slight possibility that some trans-continental F-layer openings may take place on 6 meters during December. Some openings may also be possible between the continental USA and Hawaii and between the USA and Latin America. The best time to check for F-layer 6 meter openings is from an hour or so before noon, through the early afternoon hours.

There is a tendency for sporadic-E propagation to reach a minor seasonal peak during December and early January (a major peak occurs during the summer months). This is expected to result in a number of short-skip openings, between distances of approximately 800 and 1400 miles on 10 and 6 meters. Although the early evening hours are generally favored for such openings, they may occur at any time.

A major meteor shower, the *Geminids*, is expected to take place during the second week of December. Some short-skip v.h.f. openings, up to distances of approximately 1000 miles, may be possible as a result of the ionization produced by the meteors as they enter the earth's atmosphere.

V.h.f. ionospheric openings over several hundred miles are also likely to occur during periods of auroral displays or ionospheric storminess. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are likely to be disturbed or below normal during December. Auroral openings are most likely to occur on these days.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly mean sunspot number of 73 for September, 1967. This results in a 12-month running smoothed sunspot number (upon which the sunspot cycle is based) of 78 for March, 1967, as the present cycle continues

to rise in intensity. A smoothed sunspot number of 101 is forecast for December. This is the first time that solar activity has exceeded the 100-level since mid-1960.

This month's column contains DX Propagation Charts for December, 1967 and January, 1968. Short-skip Charts for December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere, for a Merry Christmas and a very Happy New Year.

73, W3ASK

DECEMBER 1967 & JANUARY 1968
Time Zones: EST (24-Hour Time)
EASTERN USA To:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe & North Africa	07-08 (1) 08-09 (2) 09-11 (4) 11-12 (3) 12-13 (2) 13-14 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	01-07 (2) 07-09 (3) 09-11 (2) 11-13 (3) 13-15 (4) 15-16 (3) 16-23 (2) 23-01 (1)	15-17 (1) 17-19 (2) 19-00 (4) 00-03 (2) 03-04 (1) 19-23 (1)* 23-01 (2)* 01-02 (1)*
North- ern Europe & Euro- pean USSR	07-08 (1) 08-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-08 (2) 08-11 (3) 11-12 (2) 12-13 (1)	22-23 (1) 23-02 (2) 02-06 (1) 06-08 (2) 08-12 (3) 12-14 (2) 14-16 (1)	16-19 (1) 19-23 (2) 23-03 (1) 19-20 (1)*
Eastern Mediterranean & Middle East	07-08 (1) 08-10 (3) 10-11 (2) 11-13 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (4) 11-12 (3) 12-14 (2) 14-15 (1)	06-08 (2) 08-10 (1) 10-11 (2) 11-14 (3) 14-19 (2) 19-23 (1) 23-01 (2) 01-06 (1)	18-20 (1) 20-22 (2) 22-00 (1) 20-23 (1)*
West Africa	08-09 (1) 09-10 (2) 10-11 (3) 11-13 (4) 13-14 (3) 14-16 (2) 16-17 (1)	06-07 (1) 07-09 (2) 09-13 (3) 13-15 (4) 15-17 (3) 17-18 (2) 18-19 (1)	02-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-15 (3) 15-19 (4) 19-22 (3) 22-02 (2)	18-21 (1) 21-00 (2) 00-02 (3) 02-03 (2) 03-04 (1) 00-03 (1)*
East & Central Africa	07-09 (1) 09-10 (2) 10-14 (3) 14-15 (2) 15-17 (1)	06-07 (1) 07-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-18 (2) 18-19 (1)	12-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-01 (2) 01-03 (1)	19-01 (1)
South Africa	06-07 (1) 07-09 (2) 09-12 (4) 12-13 (3) 13-14 (2) 14-15 (1)	06-10 (1) 10-12 (2) 12-14 (3) 14-17 (4) 17-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-17 (3) 17-20 (4) 20-00 (2) 00-03 (1)	18-19 (1) 19-21 (2) 21-00 (1) 19-22 (1)*
Central & South Asia	08-10 (1) 17-19 (1)	07-08 (1) 08-10 (2) 10-11 (1) 17-21 (1)	06-07 (1) 07-09 (2) 09-12 (1) 18-21 (1) 21-23 (2) 23-01 (1)	06-08 (1) 20-22 (1)
South- east Asia	09-10 (1) 10-11 (2) 11-13 (1) 18-20 (1)	09-13 (1) 13-14 (2) 14-15 (1) 18-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-21 (2) 21-22 (1)	05-07 (1)

* Predicted times of 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a forecast rating of (2), or higher.

Far East	17-18 (1) 18-19 (2) 19-20 (1)	16-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	16-18 (1) 18-20 (2) 20-22 (3) 22-03 (2) 03-06 (1) 06-08 (2) 08-10 (1)	05-08 (1) 05-07 (1)*
Guam & Pacific Islands	12-14 (1) 14-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	09-11 (1) 11-13 (2) 13-16 (1) 16-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	12-19 (1) 19-21 (2) 21-22 (3) 22-00 (4) 00-03 (3) 03-04 (2) 04-07 (1) 07-09 (4) 09-12 (2)	01-02 (1) 02-04 (2) 04-07 (3) 07-08 (2) 08-09 (1) 04-05 (1)* 05-07 (2)* 07-08 (1)*
Austra- lia & New Zealand	10-12 (1) 15-17 (1) 17-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	08-10 (1) 10-12 (2) 12-16 (1) 16-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	00-02 (2) 02-05 (3) 05-07 (2) 07-09 (3) 09-11 (2) 11-15 (1) 15-18 (2) 18-00 (1)	03-05 (1) 05-07 (2) 07-09 (1) 05-08 (1)*
North- ern & Central South America	07-08 (1) 08-10 (3) 10-12 (2) 12-14 (3) 14-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-10 (4) 10-15 (3) 15-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	07-09 (4) 09-11 (3) 11-16 (2) 16-18 (3) 18-23 (4) 23-02 (3) 02-03 (2) 03-05 (1) 05-07 (2)	18-20 (1) 20-22 (2) 22-00 (3) 00-04 (2) 04-07 (1) 19-21 (1)* 21-02 (2)* 02-05 (1)*
South- ern Brazil, Argen- tina, Chile & Uru- guay	07-09 (1) 08-12 (2) 12-15 (3) 15-16 (4) 16-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	13-14 (1) 14-15 (2) 15-17 (3) 17-21 (4) 21-02 (3) 02-04 (2) 04-06 (1) 06-08 (2) 08-09 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-03 (1)*
Mc- Murdo Sound, Antarc- tica	08-11 (1) 16-19 (1)	06-07 (1) 07-09 (2) 09-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	18-19 (1) 19-22 (2) 22-03 (3) 03-04 (2) 04-06 (1) 06-08 (2) 08-09 (1) 04-06 (1) 06-08 (2) 08-10 (1)	22-00 (1) 00-02 (2) 02-05 (1)

Time Zones: CST & MST (24-Hour Time)
CENTRAL USA To:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe & North Africa	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (4) 12-13 (2) 13-14 (1)	01-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-13 (3) 13-16 (2) 16-19 (1) 19-22 (2) 22-00 (1) 00-02 (2)	16-18 (1) 18-23 (2) 23-02 (1) 19-23 (1)* 23-00 (2)* 00-01 (1)*
North- ern Europe & Euro- pean USSR	07-09 (1) 09-10 (2) 10-11 (1)	06-07 (1) 07-10 (2) 10-12 (1)	22-00 (1) 00-02 (2) 02-06 (1) 06-08 (2) 08-11 (3) 11-12 (2) 12-14 (1)	17-19 (1) 19-22 (2) 22-01 (1) 19-00 (1)*
Eastern Mediterranean & Middle East	07-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (2) 12-13 (1)	23-02 (1) 02-07 (1) 07-10 (2) 10-12 (3) 12-17 (2) 17-18 (1)	18-23 (1) 20-22 (1)*
West & Central Africa	07-09 (1) 09-10 (2) 10-12 (3) 12-15 (4) 15-17 (2) 17-18 (1)	06-09 (1) 09-11 (2) 11-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-03 (1)	18-21 (1) 21-23 (2) 23-01 (1) 22-00 (1)*

East Africa	07-09 (1) 09-13 (2) 13-15 (1)	06-11 (1) 11-12 (2) 12-15 (3) 15-17 (2) 17-18 (1)	11-15 (1) 15-16 (2) 16-19 (3) 19-21 (2) 21-00 (1)	19-00 (1)
South Africa	07-08 (1) 08-10 (2) 10-13 (3) 13-14 (2) 14-15 (1)	06-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-19 (1)	07-13 (1) 13-15 (2) 15-16 (3) 16-19 (4) 19-20 (3) 20-22 (2) 22-02 (1)	18-19 (1) 19-21 (2)
Central & South Asia	07-09 (1) 18-20 (1)	07-09 (1) 18-19 (1) 19-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-22 (2) 22-00 (1)	06-08 (1) 19-21 (2) 21-23 (1) 19-22 (1)*
South-east Asia	09-10 (1) 10-12 (2) 12-13 (1) 16-17 (1) 17-19 (2) 19-20 (1)	09-10 (1) 10-12 (3) 12-13 (2) 13-16 (1) 16-18 (2) 18-20 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-18 (1) 18-20 (2) 20-21 (1)	04-07 (1)
Far East	15-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	15-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	15-16 (1) 16-19 (2) 19-21 (3) 21-00 (2) 00-06 (1) 06-10 (2) 10-12 (1)	02-08 (1) 04-07 (1)*
Guam, Pacific Islands & New Zealand	10-12 (1) 12-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-16 (1) 16-17 (2) 17-20 (3) 20-21 (2) 21-22 (1)	07-09 (3) 09-11 (2) 11-18 (1) 18-20 (2) 20-22 (3) 22-00 (4) 00-02 (3) 02-04 (2) 04-07 (1)	23-01 (1) 00-02 (2) 02-07 (3) 07-08 (1) 02-04 (1)* 04-06 (2)* 06-07 (1)*
Australia	10-14 (1) 14-18 (2) 16-18 (3) 18-19 (2) 19-21 (1)	08-09 (1) 09-12 (3) 12-14 (2) 14-15 (3) 15-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	05-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-15 (1) 15-17 (2) 17-20 (1) 20-00 (2) 00-02 (1) 02-05 (2)	02-04 (1) 04-05 (2) 05-07 (3) 07-09 (1) 04-07 (1)*
Northern & Central South America	07-08 (1) 08-10 (3) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2)	06-07 (1) 07-08 (2) 08-12 (3) 12-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	06-07 (2) 07-11 (3) 11-15 (2) 15-17 (3) 17-22 (4) 22-01 (3) 01-03 (2) 03-06 (1)	18-20 (1) 20-23 (2) 23-01 (3) 01-04 (2) 04-06 (1) 19-21 (1)* 21-01 (2)* 01-04 (1)*
Southern Brazil, Argentina, Chile, & Uruguay	07-08 (1) 08-11 (2) 11-14 (3) 14-16 (4) 16-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	04-06 (1) 06-08 (2) 08-14 (1) 14-15 (2) 15-17 (3) 17-20 (4) 20-02 (3) 02-04 (2)	19-21 (1) 21-02 (2) 02-05 (1) 21-04 (1)*
Mc-Murdo Sound, Antarctica	08-11 (1) 17-20 (1)	06-07 (1) 07-09 (2) 09-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-23 (1)	17-19 (1) 19-22 (2) 22-02 (3) 02-04 (2) 04-06 (1) 06-08 (2) 08-09 (1)	22-05 (1)

Time Zone: PST (24-Hour Time)
WESTERN USA To:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western Europe & North Africa	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-09 (2) 09-10 (3) 10-11 (2) 11-12 (1)	02-07 (1) 07-10 (2) 10-12 (3) 12-14 (2) 14-19 (1) 19-22 (2) 22-00 (1) 00-02 (2)	18-00 (1) 19-23 (1)*

Central & North-ern Europe & Euro-pean USSR	07-09 (1)	06-07 (1) 07-09 (2) 09-10 (1)	22-00 (1) 00-02 (2) 02-07 (1) 07-09 (2) 09-10 (3) 10-11 (2) 11-13 (1)	17-00 (1) 19-23 (1)*
Eastern Mediter-ranean & East Africa & Middle East	07-09 (1)	07-08 (1) 08-10 (2) 10-11 (1)	20-22 (2) 22-00 (1) 00-04 (2) 04-07 (1) 07-10 (2) 10-14 (1) 14-16 (2) 16-17 (1)	18-21 (1)
West & Central Africa	07-09 (1) 09-11 (2) 11-14 (4) 14-16 (2) 16-17 (1)	06-09 (1) 09-11 (2) 11-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	05-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1) 23-02 (1)	18-22 (1) 19-21 (1)*
South Africa	07-08 (1) 08-10 (2) 10-13 (3) 13-14 (2) 14-15 (1)	06-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	07-12 (1) 12-14 (2) 14-15 (3) 15-18 (4) 18-20 (3) 20-22 (2) 22-00 (1)	18-19 (1) 19-20 (2) 20-21 (1)
Central & South Asia	07-09 (1) 17-18 (1) 18-19 (2) 19-20 (1)	07-10 (1) 16-17 (1) 17-19 (3) 19-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-22 (1)	05-07 (1) 18-20 (1)
South-east Asia	09-11 (1) 14-15 (1) 15-17 (3) 17-18 (2) 18-19 (1)	08-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-18 (3) 18-19 (2) 19-21 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-19 (1) 19-21 (2) 21-01 (1)	03-08 (1) 04-06 (1)*
Far East	14-15 (1) 15-16 (2) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	13-14 (1) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	06-08 (1) 08-12 (2) 12-14 (3) 14-18 (2) 18-21 (3) 21-22 (2) 22-04 (1) 04-06 (2)	23-00 (1) 00-04 (2) 04-06 (3) 06-08 (2) 08-10 (1) 02-08 (1)*
Guam, Pacific Islands & New Zealand	09-11 (1) 11-14 (2) 14-16 (3) 16-18 (2) 18-19 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	03-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-16 (1) 16-18 (2) 18-20 (3) 20-00 (4) 00-01 (3) 01-03 (2)	22-01 (1) 01-03 (2) 03-06 (3) 06-07 (2) 07-08 (1) 00-03 (1)* 03-06 (2)* 06-07 (1)*
Australia	10-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (2) 20-21 (1)	08-09 (1) 09-12 (3) 12-14 (2) 14-16 (1) 16-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	08-10 (3) 10-12 (2) 12-19 (1) 19-21 (2) 21-23 (3) 23-02 (2) 02-08 (1)	01-03 (1) 03-05 (2) 05-07 (3) 07-09 (1) 03-05 (1)* 05-06 (2)* 06-08 (1)*
Northern & Central South America	07-08 (1) 08-11 (2) 11-12 (3) 12-14 (4) 14-16 (2) 16-17 (1)	06-07 (1) 07-11 (2) 11-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-08 (2) 08-13 (1) 13-15 (2) 15-16 (3) 16-22 (4) 22-00 (3) 00-02 (2) 02-06 (1)	18-20 (1) 20-01 (3) 01-04 (2) 04-06 (1) 19-22 (1)* 22-01 (2)* 01-04 (1)*
Southern Brazil, Argentina, Chile & Uruguay	07-08 (1) 08-11 (2) 11-13 (3) 13-15 (4) 15-17 (2) 17-18 (1)	07-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	04-06 (1) 06-08 (2) 08-14 (1) 14-15 (2) 15-16 (3) 16-19 (4) 19-02 (3) 02-04 (2)	20-22 (1) 22-01 (2) 01-04 (1) 22-02 (1)*
Mc-Murdo Sound, Antarctica	08-11 (1) 17-20 (1)	06-07 (1) 07-09 (2) 09-17 (1) 17-21 (2) 21-23 (1)	16-18 (1) 18-20 (2) 20-00 (3) 00-02 (2) 02-06 (1) 06-08 (2) 08-10 (1)	23-05 (1)

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New Readers Service on Page 120

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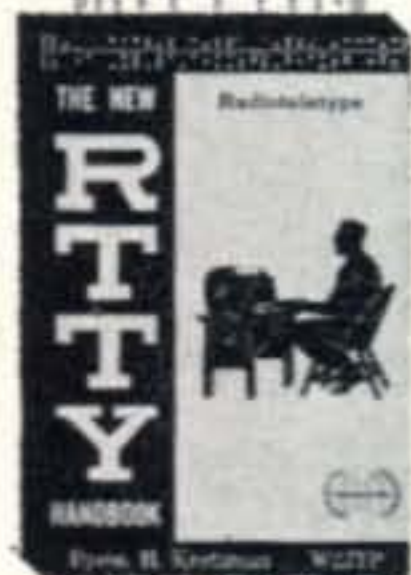
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VHF FOR THE RADIO AMATEUR

Cat. #115. If you are, or are planning to be a VHF operator you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it.



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Cat. #119. A common denominator for all ham stations is the antenna. Here at last is the cream of antenna information packed into a 160 page book. Forty-seven information-packed articles that will dispel much of the mystery surrounding antennas.



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Cat. #103. One full year in the preparation of this terrific volume. This is not a technical book. It explains sideband, showing you how to get along with it... how to keep your rig working right... how to know when it isn't... and lots of how to build-it stuff, gadgets, receiving adaptors, exciters, amplifiers.



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Cat. #122. Contains 192 pages of conversion articles including the famous Command Set's plus a whole slew of the most popular military surplus gear including such gems as: SCR-522, ART-13, BC603, BC659, ARC 1, ARC 3, etc. Actually, it covers almost every piece of surplus gear worth the effort to convert for ham use.



ELECTRONIC CIRCUITS HANDBOOK

Cat. #121. Describes and discusses in detail 150 of the most often needed circuits around the shack. Novices and old-timers alike will find many valuable circuits here ideal for construction projects. Eleven great chapters cover a multitude of circuits for all.



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THE awards PROGRAM



BY ED HOPPER,* W2GT

COUNTY HUNTER NETS

1300-1700 GMT 7225 s.s.b.

1800-2400 GMT 14336 s.s.b.

0100- GMT 3937 s.s.b.

NOTE - this was 3947

C.W.

Monday-Friday 1900-2200 GMT 7035

Saturday 1530-2130 GMT 7035

Sunday 1730-2130 GMT 7035

Monday-Friday-eves. 0000-0300 GMT 3523

FLASH!

HOWARD S. BRADLEY, W2QHH

HAS QUALIFIED FOR #4

USA-CA-3075

ALL COUNTIES SPECIAL HONORS
PLAQUE

SEE HIS FOTO AND STORY CQ
SEPT, 1966

THE "Story of The Month" is:

Howard E. Perkins, K8EUX

Howie started as an s.w.l. back in 1938 and had much fun with his SX-28 receiver and 300 foot long wire. He enjoyed confirming short wave broadcast and broadcast band stations and eventually had confirmations from 1600 broadcast stations and 74 countries on the ham bands. He was a member of the National Radio Club and the Newark News Radio Club.

In 1957 he got interested in getting a Novice license and obtained one on May 9, 1957. With a Viking Adv. xmter running 50 watts, all states were worked in 8 months. A Tech. license was obtained in 1958 and operation then went to 6 meters, fone and c.w. for 2 years, and 22 states were con-

cluded in November 1964. His confirmed county total is now 2381. He is the proud owner of 308 Awards and DXCC total of 69.

The present equipment includes an SR-150 and a 3 el. beam, and Howie is a regular on the 20 meter Independent County Hunters Net (14336), and he would like to see



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Christmas Greetings from Ted (W6UOU), Bob (W0ARA) & Walt Henry (W6NRV)



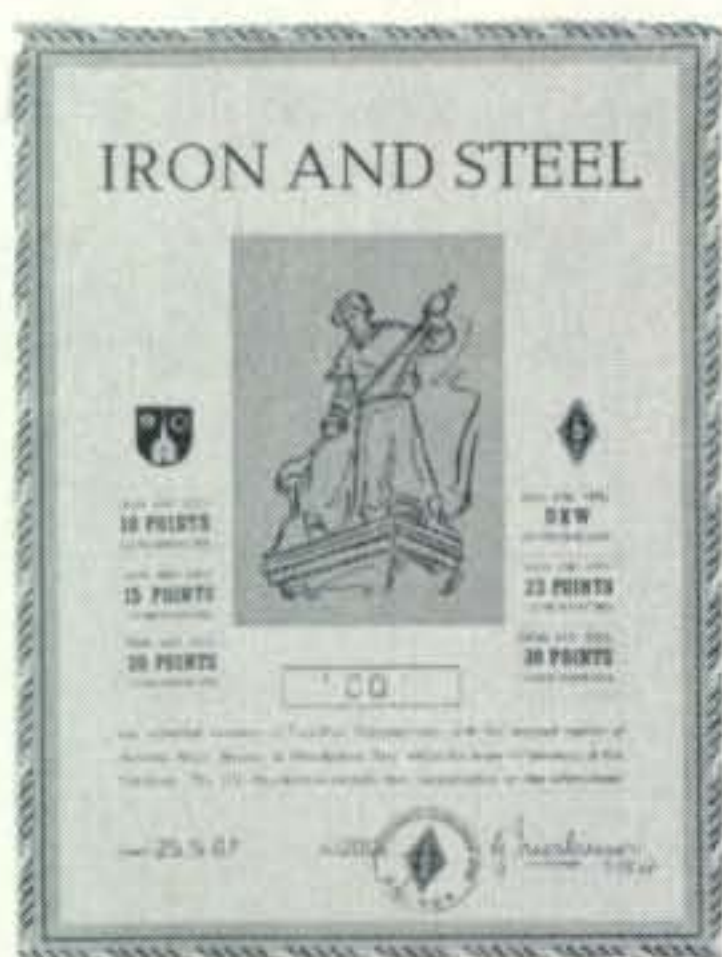
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New Readers Service on Page 120



Iron And Steel Award

the 40 M Net reactivated and busy, as before.

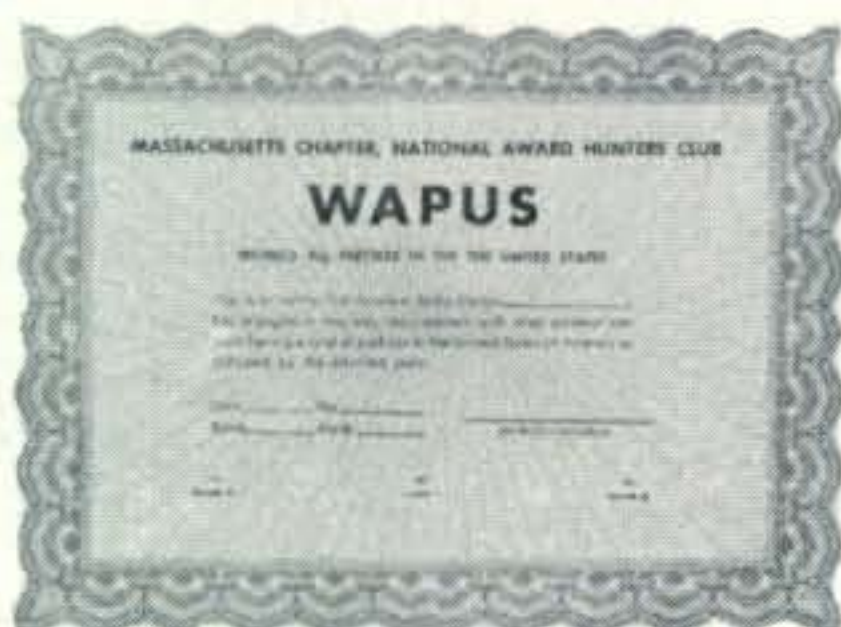
Howie is 47 years old, works at General Electric and is married to Gloria (not a ham and their son Dennis was in the Air Force for 4 years and is now living in Topeka, Kansas.

Perhaps Howie will make the convention in Dayton soon, as he would like to meet the many county hunters, eye ball, that he has met on the air.

Letters

FRED, K6DGW, ex KL7ETK/HS1FJ, writes: "I will be returning to the U.S. in early December, and I'll be getting married. We will be traveling from Los Angeles, California to Houston, Texas, taking our time, the first two weeks in January 1968. Until November 20, requests for special counties for us to pass through, during this trip, can be addressed to me, Fred C. Jensen, 4870 Tweedy Blvd., South Gate, California. QSLs can be sent to Fred C. Jensen, C/O Detachment 1, 1137th USAF Special Activity Squadron, NASA Manned Spacecraft Center, Houston, Texas.

I will check into the county hunter nets prior to the trip, and thus keep everyone up-to-date on our plans. Special QSL cards have already been ordered for QSOs during



Wapus Award

the trip and I expect to spend most of the time on s.s.b. so my new-Bride can enjoy it." (*Congratulations and Happy Hunting, Ed.*) **Eric, K7ABV/7,** writes: "I will be active in Park County, Montana for 2 years using a KW to a vertical and a Drake 2B. Watch for me near 14075, 0000-0100 GMT or any portion of the c.w. band. My QTH is, G. Eric Marftin, 516 South 8th, Livingston, Mont. 59047."

Gordon, ZL1HW, writes: "I wish to thank CQ for the beautiful certificate which arrived in good order. I took it straight away to be framed and it will be displayed in the most prominent position on the wall of my radio room."

Merle, W6HVV, writes: "In applying for the different state counties awards, be sure to carefully check the rules as many will NOT accept mobiles for their awards."

Dave, W4SKI/W5PWG, writes: "John, W5OYG and I are having a friendly race in snagging new counties, but he seems to beat me in getting the QSLs. We get together often and are planning a mobile trip near the end of November.

On our three month trip to Orlando, Florida on business, we visited WA4BMC, WA4FGX, K4VOF, WA4NBC and K4WVX.

I would like to see the Top Twenty-Five Special Honor Roll listed more often.

I am at a new location, on a hill top, and because of it I am already wrong in the 1967 (Fall) callbook.

I would be glad to help DXers with QTHs if they drop me a line, my new QTH is David S. Short, 4828 Williams, Lawton, Okla. 73501." (*Re: Top 25, fellows near the top keep their score a secret and other are too busy chasing counties to write, Ed.*)

Awards

The College Bowl Award is issued by the Massachusetts Chapter, National Awards Hunters Club for working accredited College and University Club Stations anywhere in the world. It is issued in three classes: **Class A**—work 50 in at least 20 States and/or Countries. **Class B**—work 25 in at least 10 States and/or Countries. **Class C**—work 10 anywhere in the world. Submit application with certified log data showing call of Club station, date, time, and band and mode plus name of College or University. No date or time limits. Fee for basic award is \$1.00. Seals for higher class, 10¢. No

charge for higher class seals at time of application for basic award. Free to B/P. Award will be endorsed for band and mode. If application is made for a second band or mode, fee is 25¢ as an additional certificate will be issued. Award Chairman is: Steve Rich, 31 Arlington Ave., Revere, Mass. 02151.

Worked All Prefixes, United States—WA-PUS Award, formerly issued by the Bossier High School Club is now sponsored by the Massachusetts Chapter, National Award Hunters Club for working United States call prefixes found in the U.S. section of the Call Book. (Example: W1, WA1, WN1, WB2, K3, etc.). It is issued in 3 classes—Class A, work 48 prefixes; Class B, work 32 prefixes; Class C, work 16. Submit application with GCR (General Certification Rule) list, showing call, date, time, band and mode. No date or time limits. Fee for basic award is \$1.00. Seals for higher class, 10¢. No charge for higher class seals at time of application for basic award. Free to B/P. Award will be endorsed for band and mode. If application is made for a second band or mode, fee is 25¢ as an additional certificate will be issued. Award Chairman is: Steven Rich, 31 Arlington Ave., Revere, Mass. 02151.

Piney Woods Award is issued by the Piney Woods 6 Meter Single Side Band Society for working society members. Outside of a 250 mile radius from Longview, Texas, 4 members must be worked. Inside this 250 radius, all 8 members have to be worked. You are required to send your QSL and mention that a certificate is desired and the society has weekly meetings on the air to check who desires certificates. When 4 members receive your QSL, a certificate will be sent to you. Louisiana members are: K5MFA, WA5GJO, WA5IPZ and WA5-QYQ. Texas members are: W5BEP, WA5-OIN, WA5NBS, and WA5PCD.

Iron And Steel—Eisen Und Stahl—Award is issued to licensed amateurs (and s.w.l.s) for confirmed contacts (reports) with German Amateur Stations in Neunkirchen/Saar, after January 1, 1966. European applications need 10 points and all other applications need 5 points. Each contact with a station in Neunkirchen DOK Q 03, counts 1 point. Contacts with Club-Station DL0NKG count 3 points and contacts with the station DL0RD (Robinson-Dorf) count 5 points. Contacts with the same station



The College Bowl Award

on different bands count 1 point per band. (3 point for DL0NKG, 5 points for DL0RD). Endorsement stickers will be available for 10, 15, 25 and 30 points. A charge of DM 4.—, \$1.00 or 10 IRCs is made for the award. (Stickers 2 IRCs). QSL cards need not be submitted if the application has been checked and certified by one other amateur. Apply to: Gunther Nierbauer, DJ2XP, 14 Huttenberg-str., 6680 Neunkirchen/Saar, Germany. Q 03 Stations are: DL8 AI, AM, AY, AZ, BB, BI, BT, BY, CH, CI, CR, DB, DC, DQ, DW, EI, EJ, EM, EZ, FB, FJ, GI, GL, GN, HK, HT; DL0NKG, DL0RD. DK1-AV; DL1DP; DL3ON; DJ2XP; DJ8DN.

Notes

As you read this, it will be near Christmas and we should all be cheerful and happy, but I am sad because as I write this, I have recently lost one of my best friends, Earl, W2JT, and I guess ham radio will never be quite the same for me.

I did have the pleasure of having Arthur, G2MI and his wife, Lucy as guests for a few days and it was nice to again meet some old friends.

Requests are still coming from overseas for POD 26, so it being that time of the year, do you have one as a present for such a county hunter?

Hope Santa Claus *presents* you all with many needed QSLs. Mail has been wonderful, please keep it coming and tell me—How was your month? 73, Ed. W2GT.



Piney Woods Award

SURPLUS sidelights

BY GORDON ELIOT WHITE*

I am in Europe this fall, investigating the surplus situation in England, France, Belgium, Germany, Austria and Italy, with an eye on the mountain of material that was moved out of U.S. N.A.T.O. bases in France last summer. As a result of preparations for that expedition, and the month away from my usual haunts, tinkering with equipment has been somewhat curtailed here. Thus this month's column will be a roundup of several items that have been collecting in the shack, rather than an in-depth treatment of a particular surplus goodie.

* 5716 N. King's Highway, Alexandria, Virginia 22303.

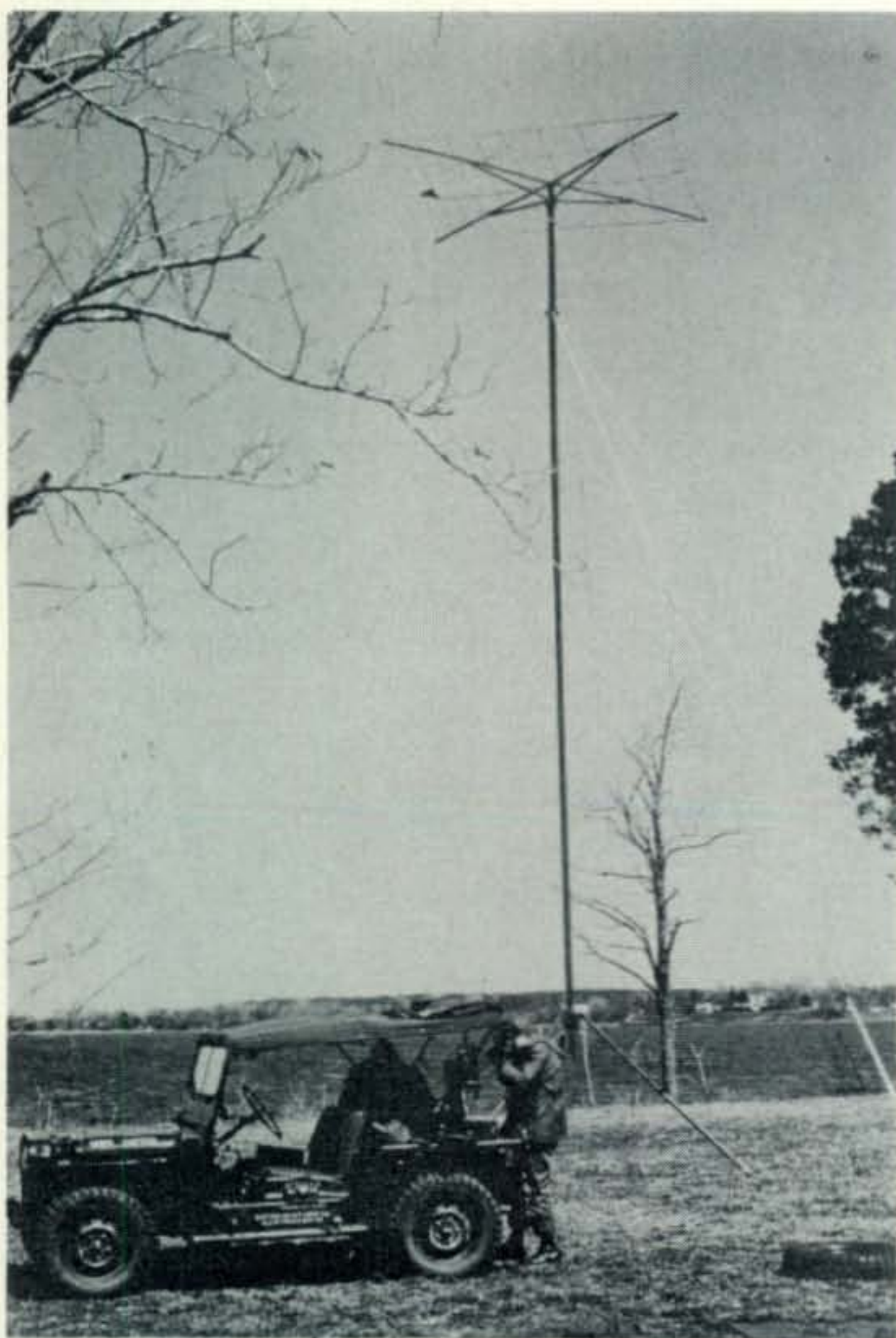


Fig. 1—ARM-160-5 log-periodic, a military antenna for the 30-76 mc band.

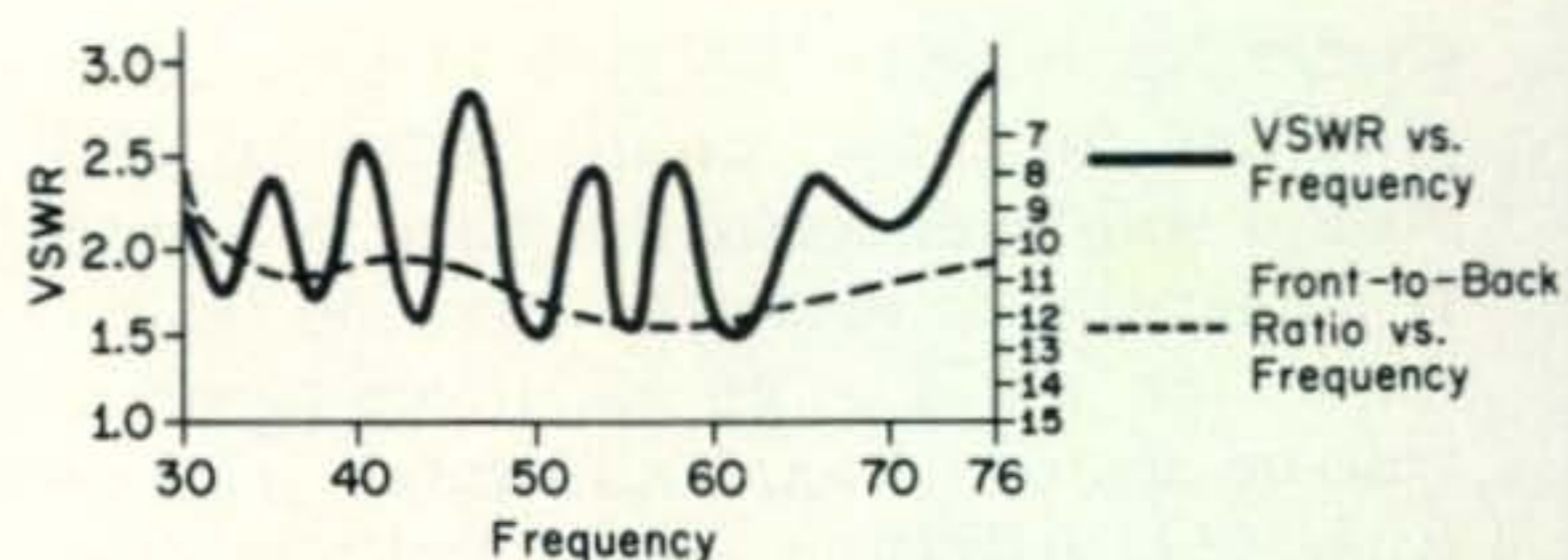


Fig. 2—Chart of v.s.w.r. for the ARM-160-5 antenna over its 46 mc band.

The first piece I want to discuss is another antenna "find," the ARM-160-5, another of the log-periodic designs that the military is adopting so widely. (see fig. 1) Readers will recall the AS-989 covered in the September and December, 1966 SURPLUS columns, and the AN/PRD-7 mentioned in October 1967. The ARM-160 is somewhat similar in construction, being a fiberglass and wire unit, quite light and easily transported, supported on the usual tripod mount.

While the ARM-160 is rated for the 30-76 mc military tactical band, its log-periodic construction gives inherent wide-band characteristics which allow overlap at each end, for what it may be worth. The design of course lends itself to 6-meter use, and it is a fortunate coincidence that the Standing Wave Ratio is at a 1.5:1 minimum in the area of 50 mc, and the front-to-back

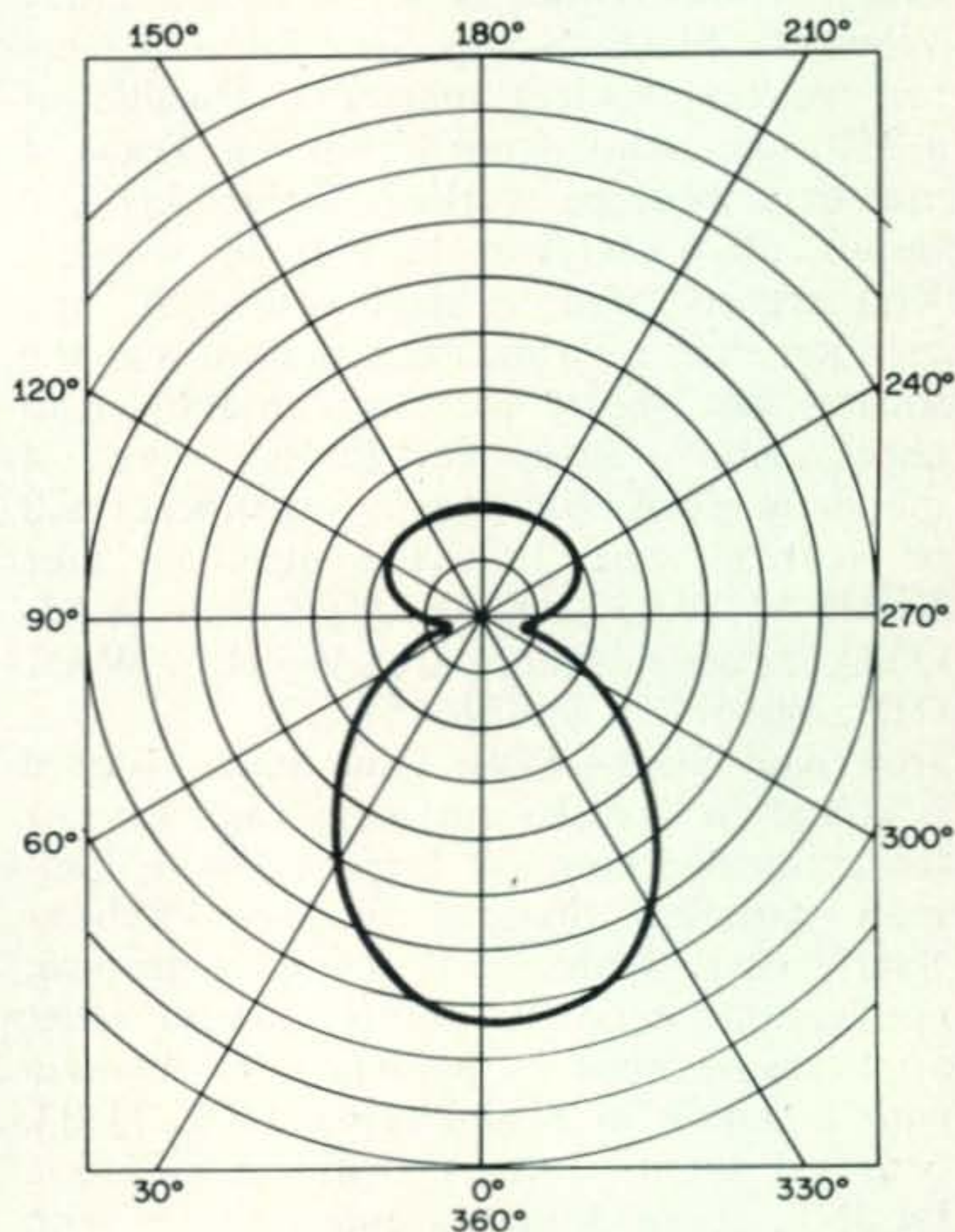


Fig. 3—Plot of voltage measurements of the ARM-160-5 antenna taken at 50 mc.

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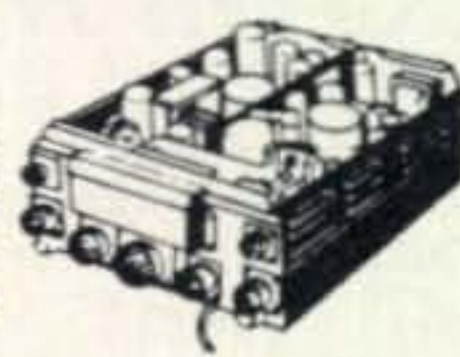
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ratio is high at that point (13:1).

Figure 2 shows the overall v.s.w.r. and front-to-back ratios for the ARM-160 antenna.

The antenna was designed by Dorne and Margolin Inc., of Chatsworth, California, with the Army and Marine Corps in mind. Gain of the ARM-160 over an ideal isotropic antenna averages about 5 db, with 5.5 db at the 50 mc point. Gain falls off at the 30 mc end and is slightly higher above the rated 76 mc high end.

A voltage plot at 50 mc is shown in fig. 3.

A useful commercial unit that has been procured also under military nomenclature is the excellent Berkeley model 554 EPUT meter (fig. 4). Under Army numbers the identical piece is known as Frequency Meter FR-67/U. The EPUT designation of course stands for "Events Per Unit Time," and distinguishes the set from ordinary counters that record total numbers of events. The EPUT meter contains a time base—an accurate 100 kc crystal oscillator and a "gate" that opens to receive the input for a precisely-measured one second interval. The counting decades thus may be read directly in events-per-second (cycles per second) up to, for the FR-67/U, 100 kc. The low end of sensitivity for this unit is 20 c.p.s. It will measure any type of event that may be converted to an electrical signal, be it optical, electrical or mechanical. It is ordinarily quite handy for audio-frequency work, for example constructing RTTY filters.

The beauty of the Berkeley EPUT unit is that they are direct-reading, and highly accurate. Short-term stability of the temperature-controlled crystal oscillator is one part in 1 million or better, thus at the upper end of its range the EPUT is accurate to plus or minus a single cycle.

This is all the accuracy that can be obtained in a device of this type, since a one-cycle error is inherent in random opening of the "gate" in the counter. Such accuracy is useful in setting less-accurate local oscillators in the shack, such as a home-brew audio oscillator which is then used to build and test a tone filter. Dial accuracy and resetability of the oscillator is not important, since it may be set with the EPUT meter and only reasonable stability is needed thereafter.

This use can suggest many other applications including the calibration of low-frequency r.f. oscillators, two-tone s.s.b. test generators, etc. Calibration of a transmitter

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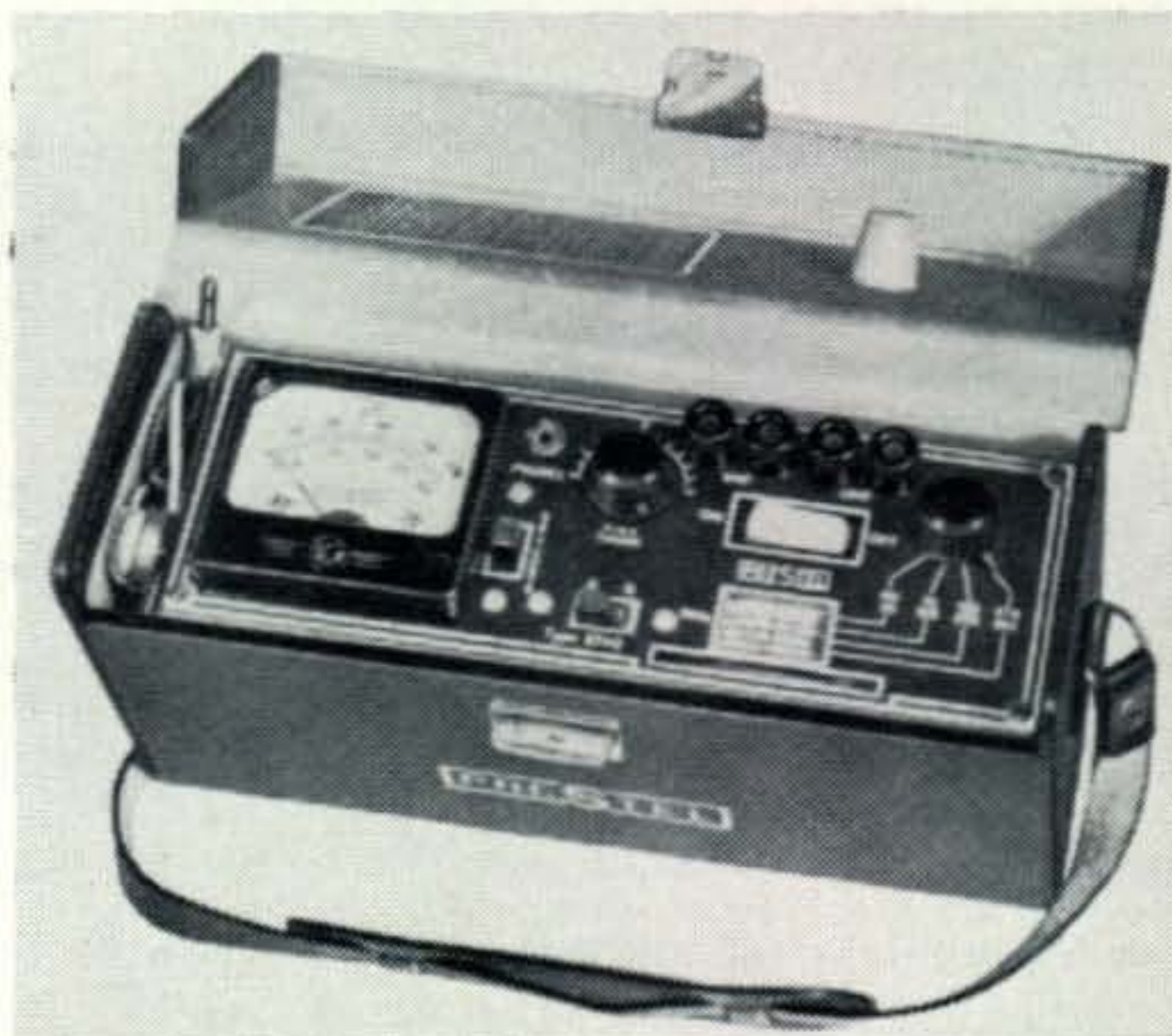
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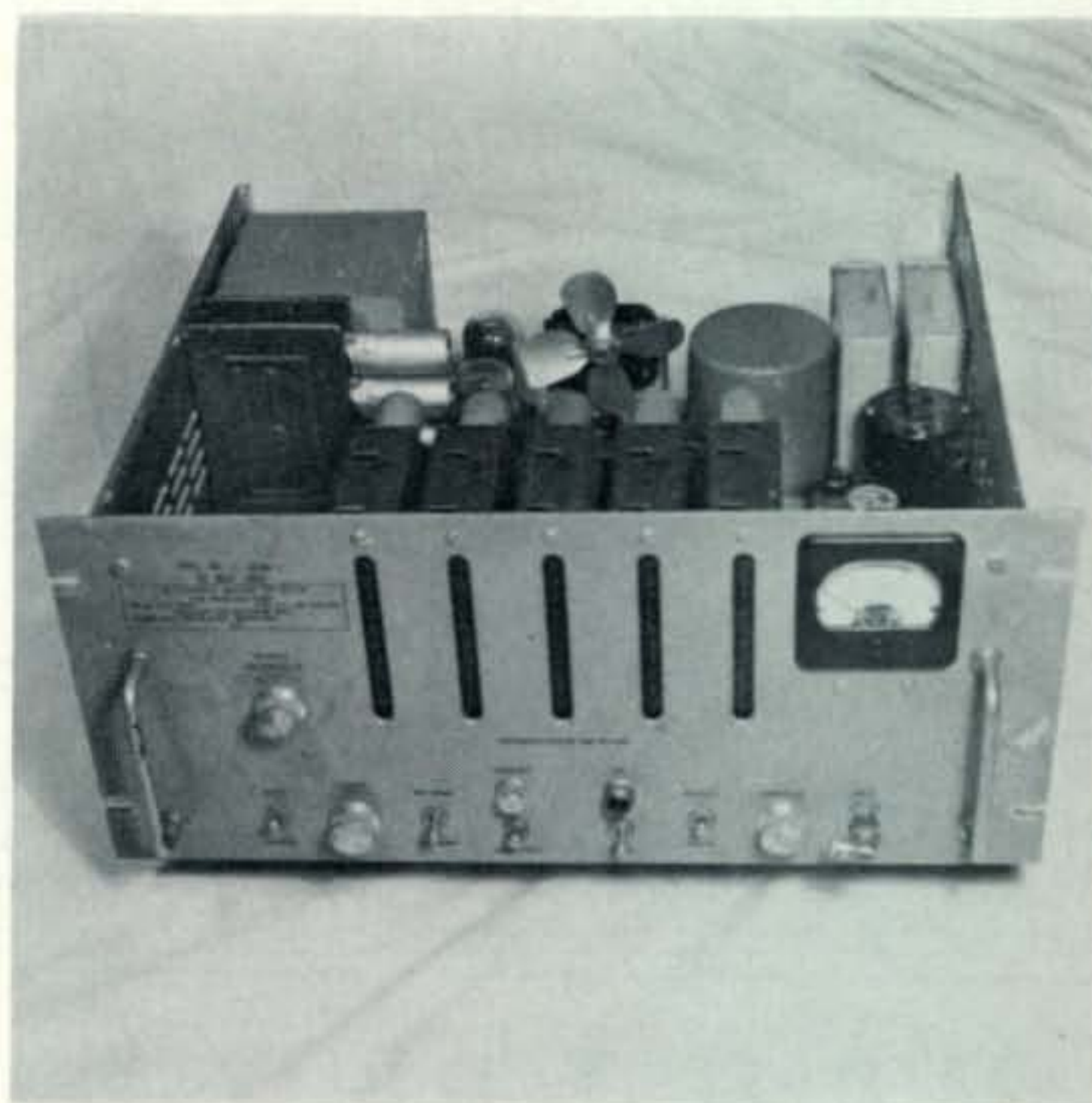


Fig. 4—The FR-67/U frequency meter, a military version of the Berkeley-Beckman model 554 Events-Per-Unit-Time counter.

or other high-frequency oscillator may be made by approaching zero beat, say to 100 cycles, and measuring the tone on the EPUT, with the WWV or other reliable signal as the standard.

Of course an EPUT meter can be used, with a suitable pickup device, to time rotating machinery, vibration, etc. Certain frequency-modulated telemetry information may also be displayed, recording it with photographic equipment.

The FR-67/U is made up of separate sub-chassis for the power supply, time base, and input circuits. The decade counter units are self-contained in octal-based modules. The set is designed for 19 inch rack mounting, though of course table-top cabinets may be found. Weight is 68 pounds. Signal input may be any wave shape with an amplitude between 0.2 and 20 volts rms.

The first use I put the counter to was setting of an old but exceedingly solid General Radio electrically-driven tuning fork to 425 cycles per second for RTTY work. (Basic RTTY tones are multiples of 425 c.p.s.) The very simple procedure was to time the fork output on the EPUT meter, then lighten the tines progressively until 425 c.p.s. was displayed. Since the original frequency of the unit was 400 c.p.s., we drilled identical holes in the top of each tine, enlarging the hole size by careful steps. If we had wanted to lower the frequency we could have added weight to the tine ends or removed metal from the base of the fork, between the tines.

Another useful military series is the Navy panoramic adaptor lineup of RBV, RBU, RBW, RCX, and their -A, -B etc. models. These are late World War II units, manufactured primarily by the Panoramic Radio Corporation, New York, but also produced by several other wartime contractors. The manual on this series is *NavShips 900288*.

Panadaptors are hooked to a receiver following the mixer stage, and must be designed (or adjusted) to match the receiver intermediate frequency. They amplify the i.f. signal and present it as a visual display on a cathode ray tube. A prime characteristic of panadaptors is their ability to show a wide band of frequencies, possibly 200 kc for the RCX, which is designed to work with the standard 455 kc receiver i.f. To attain that much bandwidth, a panadaptor must be attached *before* the signal goes through the receiver i.f., which is designed to provide *selectivity* and *eliminate* signals outside a band which may be as narrow as a few hundred cycles. The RCX for example, should be attached to the plate of the mixer tube, through a 25 k resistor. (To reduce effects on receiver output, a cathode follower would be a useful addition for its isolation value.)

Here are the characteristics for the four different Navy panadaptor models:

Model	i.f. input	sweep width	sensitivity
RBU-1	400 kc	50 kc	50 microvolts at 400 kc for ¼ inch vertical deflection, with signal applied at input cable
RBV-1	400 kc	100 kc	(same)
RCX	450-470 kc	200 kc	200 microvolts applied through 25 K coupling resistor, for ¼ inch vertical deflection at center
RBW	5.25 mc	1 mc	same as RCX except 50 K coupling resistor

All four units use 11 tubes, including a 3BP1 c.r.t. a.c. power may be 115 or 230 volts, 60 or 50 cycles, with provision for changing power transformer input taps for high or low voltage input.

The blanking provision on the RCX and RBW is normally not used. Blanking voltage up to 165 volts would be applied to J-103 with control by the front panel "blanking" knob.

The RBU-1 was normally used with the Navy RBB receiver, and the RBW-1 with the RBC (see *CQ* Nov. 1966, p. 96.)

The theory of a panoramic adapter involves feeding the receiver i.f. to the unit where the signal is converted to a second, lower i.f., (226 kc in the case of the RBU, RBW and RCX) via a mixer and a frequency-modulated local oscillator. The frequency of the local oscillator is varied over the appropriate bandwidth—200 kc for the RCX—by a sawtooth oscillator that is locked to a submultiple of the a.c. power supply, in this case 30 c.p.s. This effect varies the displayed trace over the desired band. The resulting signal is applied to the vertical plates of the c.r.t.

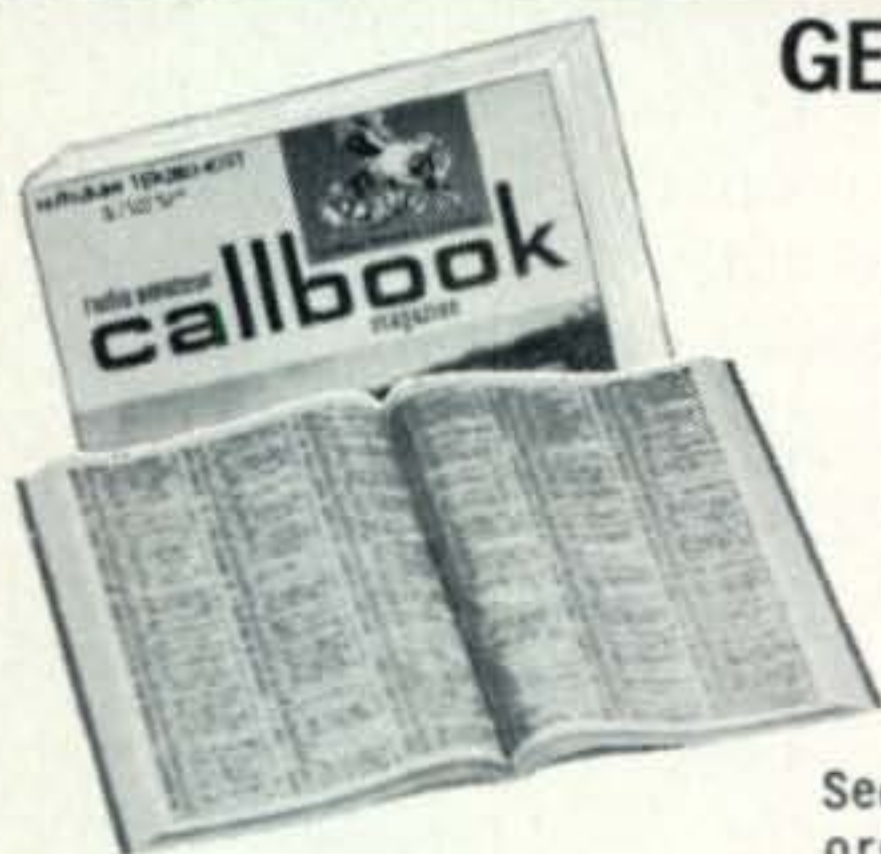
At the same time, the 30 c.p.s. sawtooth signal is applied to the horizontal c.r.t. plates, thus synchronizing the movement of the display beam with the tuning of the oscillator.

A panadaptor of course is useful for surveying a relatively wide portion of the r.f. frequencies, up to 1 mc wide for the RBW. The initial use was for laboratory work, but during World War II the panoramic presentation was used chiefly for scanning the r.f. frequencies for intelligence purposes. Our operators watched for enemy signals which were characteristically brief, and on unpredictable frequencies. The panadaptor shows such signals graphically, allowing appropriate countermeasures, either jamming or interception. The same facilities watched friendly channels for violations of communications security, and looked, on higher bands, for enemy radar, which had to be defeated to allow the Allies' bombing raids to penetrate to German and Japanese targets.

In amateur work a panadaptor will show clear spots in the QRM and can be used for other purposes. With alteration of the sweep oscillator for a narrow displayed spectrum width, RTTY signals may be tuned, using the panadaptor. In that situation, the sweep would need to be no more than 1 kc at the extreme, (500 c.p.s. each side of center) since the widest RTTY frequency shifts in amateur use are 850 c.p.s. apart.

I have gotten quite a bit of mail recently asking about technical manuals. While I will be glad to answer all questions when a stamped, self-addressed envelope is enclosed, most military handbooks may be obtained directly from two dealers, both amateurs, who specialize in such material. Sam Consalvo, 4905 Roanne Dr., Oxon Hill, Md., and Bill Slep, box 178, Ellenton, Florida, can fill most orders.

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Grumbles [from page 50]

material for a future issue which will further explore this whole area of boring ham conversations and offer specific suggestions for those of you who wish to try to talk on other subjects but haven't read anything but ham publications for the past few years. Watch for it, it may make you an "instant person."

Some of my readers express annoyance at the fact that I don't head up this section with my callsign. It bothers people that anyone who has a chance to get his name in print would choose to remain anonymous—lacking even a last name. I can assure you that I have the potential to enjoy basking in the sunlight of reader adoration as well as the next fellow, however I honestly don't feel that I could unload any real opinions on you and still maintain any personal privacy or sanity if you knew where to come to grab me by the lapels. It's no big federal secret, mind you, it's just that if we got into any kind of eyeball-to-eyeball confrontation about anything upon which both of us violently disagree there might be many problems in the aftermath. You might decide to beat me about the head and neck with a rolled up Callbook, and, on the other hand I might do the same to you. With the money CQ pays me for this section I'd never be able to defend any assault (too undernourished for a physical defense and too underfinanced for a legal defense).

In any event, keep those gripes coming; it lets me know that I'm not the only one in the world annoyed at all of the dumb things going on.

Annual Convention [from page 80]

with the pattern raised enough to be read.

I think the object of these talks and the others that followed was not only a pep talk for the students to increase their motivation but to those of us covering the convention to see the potential of these students. The questions asked by the audience were by far more sophisticated and technical than I have seen in other students their age and reflected their keen interest and understanding. Naturally they are concerned with future employment now that automation has taken over some of the assembly line work formerly done by the blind and so they seek continually for new ways to do old jobs, and new outlets for their talents.

New Readers Service on Page 120



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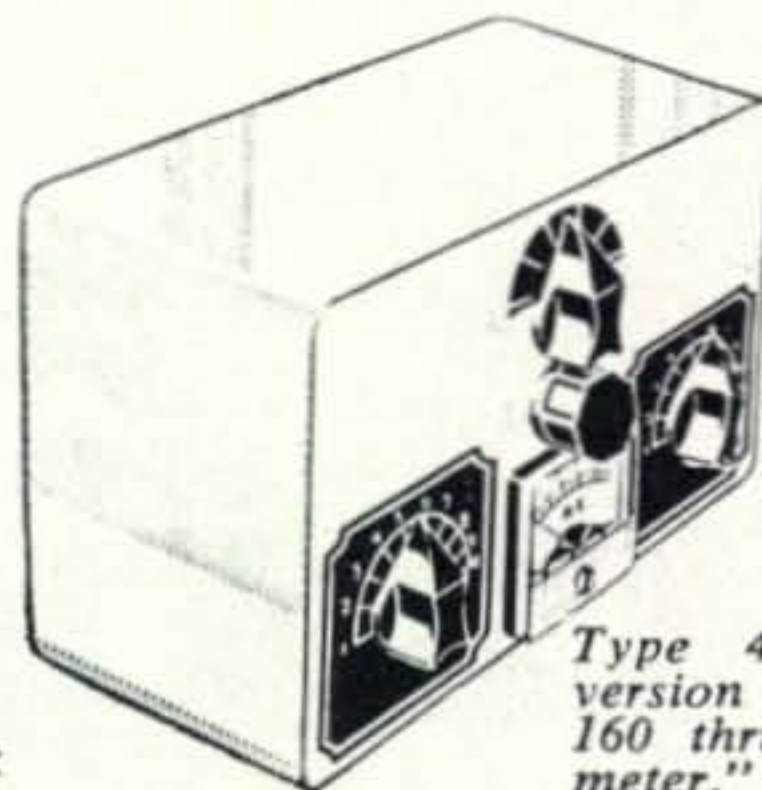
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If you would like to have more information on teaching programs for the blind contact: Bob Gunderson, W2JIO, 999 Pelham Parkway, Bronx, New York. He'll answer you in between his other duties as teacher at the Institute, writer and editor of the *Braille Tech Press*, producer of talking records for the blind, inventing, lecturing, and so on. Oh yes, he's also blind.

DXing the Galaxy

[from page 62]

words beginning with mouth forming letters "B", "P", and "M". Toby was the only wet blanket in the group. He was not very encouraging when he advised that the telescope had been pointed towards the "Horse-head Nebula" in the constellation of Orion. "Whats wrong with that Toby?" I asked. "That constellation is only 1000 light years away" he sadly informed us.

Did we actually receive an intelligent transmission from the constellation of Orion? One thing is sure! the three of us are not stopping now. Every weekend will find us using the telescope, the Monochrometer, and recording all we hear IF we are that lucky again.

DX [from page 88]

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[Continued on page 112]

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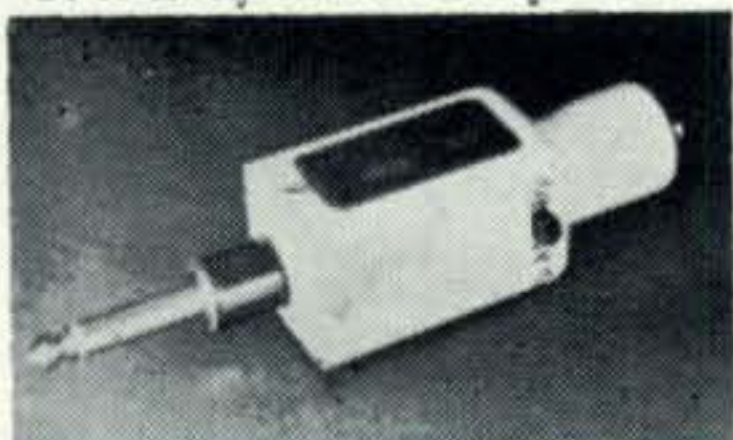
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CT1NW — Via W2CTN
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FP8CA — To K2OJD
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FP8CS — Via KA2OJD
FP8DJ — To WB2FXB
FY7YG — Via W2CTN
GB2AA — To Adrian T. James, G3RUV, 18 Lonsdale Rd., Heavitree, Exeter, Devon, England
GC3MWR — c/o W2CTN
GM5AFI — Via WA2KPS
HB0LL — To WA0QVQ
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KW6EK — Via W2CTN
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SM5CAK — To WA9AEA, W.B. Early, 6830 N. Sheridan Road, Chicago, Ill. 60626
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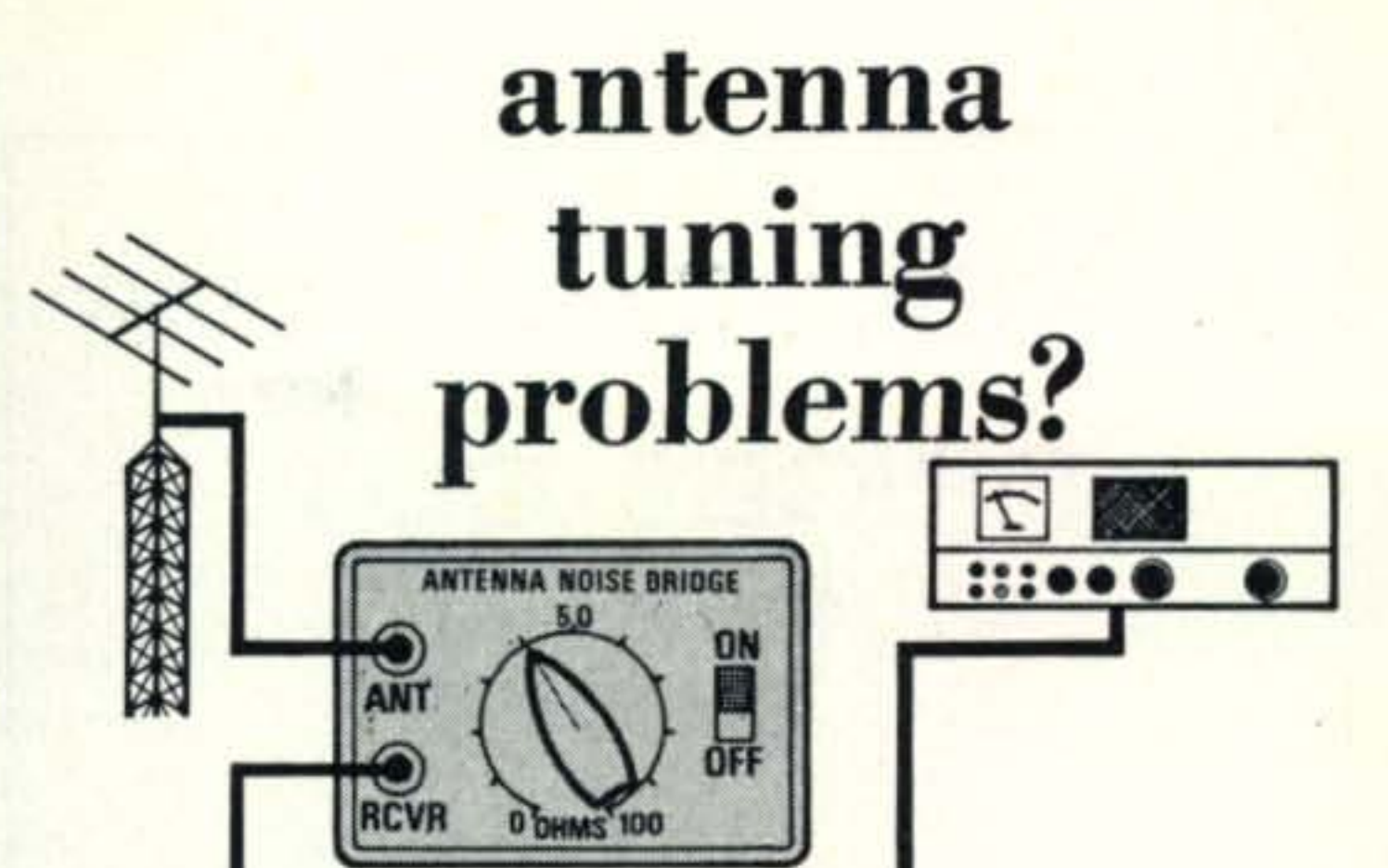
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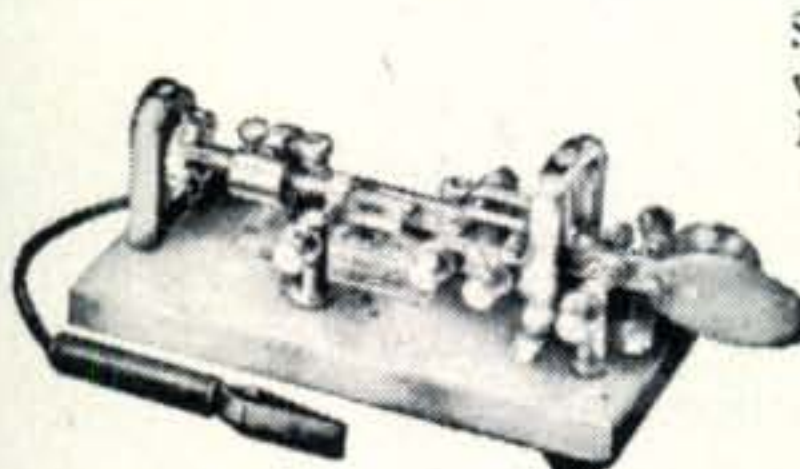


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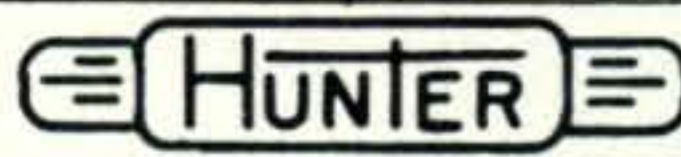


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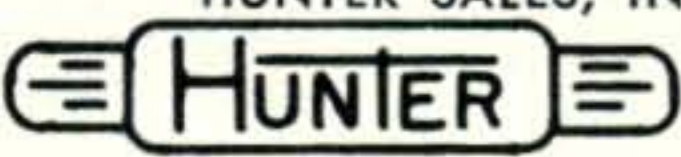
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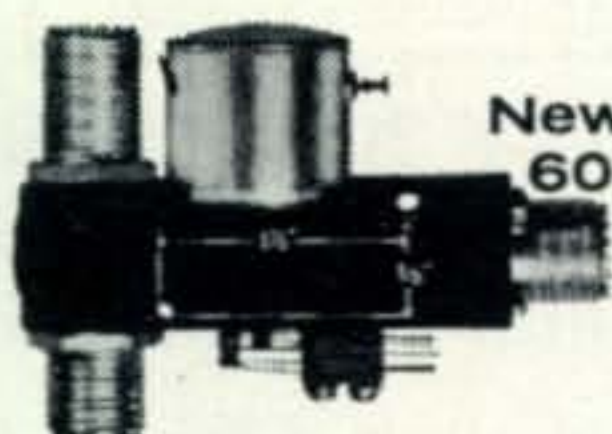


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A 25 kc Multivibrator

[from page 28]

of the 100 kc points and located between them. Starting from the clockwise position (maximum resistance), *slowly* adjust R_6 for an audible beat at this spot. The 25 kc signal will suddenly jump in or out as R_6 is varied through the correct setting. The receiver dial may have to be rocked slightly back and forth (about 1 kc or so) to exactly locate the proper signal during the process.

Only three major signals should then be found equally spaced between the 100 kc spots, one each at the 25, 50 and 75 kc intervals. If this condition does not result or if the signal sounds unstable or "gurgly," go back and slightly readjust R_6 . At an adjustment near the correct setting, strong signals also might be found at the 12.5 kc multiples, so again slightly reset R_6 , until they disappear while still maintaining the 25 kc intervals.

With some receivers, weaker signals may be heard at other spots. This depends on the receiver's conversion scheme and the frequency of its heterodyning oscillators which may mix with calibrating harmonics. In some cases weak markers may be heard at every 5 kc interval in addition to the major 25 kc ones.

After R_6 has been set, turn the calibrator switch off and on to make sure the multivibrator properly locks in on frequency each time.

If difficulty should be encountered in getting the multivibrator to synchronize at only 25 kc, it may be due to excessive or insufficient drive from the calibrator or due to excessive loading by the antenna circuit. One of the coupling capacitors, C_3 or C_4 should then be altered accordingly.³

Finally, check the calibrator adjustment and if necessary, reset it for zero-beat with WWV.

Both the calibrator and the multivibrator will always be in operation together, but if it is desired to eliminate the 25 kc intervals, leaving only the 100 kc ones, a separate B-plus or cathode switch will have to be installed to cut off the multivibrator. ■

³ Pin 2 of V_1 could be grounded directly, but it has intentionally been placed above ground with R_3 in the event difficulty is encountered, under some conditions, in obtaining positive synchronization and stable operation, in which case the 100 kc calibrator output should be fed through a 0.5-5 mmf capacitor to pin 2, instead of to pin 6.

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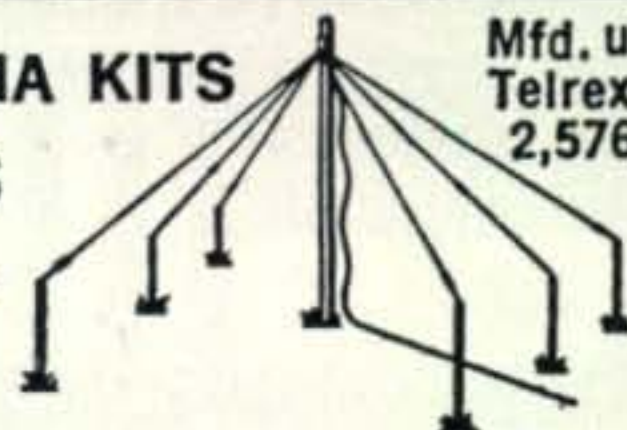


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WANTED: to buy lakeshore bandhopper VFO, M. Breyfogle, 18 N. 7th St, Estherville, Iowa 51334.

SALE: Model 28KSR Teletype cabinet, floor console style. \$40, one only. J. Thomsen, 8280 Tennessee Ave, Clarendon Hills, Ill. 60514.

RITTY TEST set I-193-A new unused. Inst. Manual Cost Government \$600. will sell for \$100. James R. Houston, Limestone, Tenn. 37681.

WANTED used correspondence courses radio/TV servicing electronics also old radio books, phonographs. Mike Hoshiki, Southern Ill. University, Speech & Audiology, Carbondale, Ill. 62901.

HAVE complete set of National Geographic magazines from 1925 to 1960. Will sell or trade for ham gear. F. Gresley, RR3 Metcalfe St., Newcastle, Ont. Can.

DRAKE 2B with xtal calibrator and manual 1/n \$180. Eldico 100 F 1/n \$200. Manual. Local Only. H. Berner, 1033 E. 9th St., Brooklyn 30, N.Y. 11230.

\$10 for collins 312B3 (less speaker) or DK60-G2C or T4X Tube complement (new) or 8236 and 7360 for Swan mono or 240. 9 Novice crystals 40-15, \$4.00. DR. Morris, Box 309, Ripley, W. Va. 25271.

EICO 753 tri-band transceiver and 751 A.C. Power supply. Transistor VFO. Factory checked for stability. In use. Excellent CW reports. \$200 FOB my Qth. J. Weaver, 11652 Hollingsworth Way, Forest Park, Ohio 45240.

HT-37 Hallicrafters, \$195. Central Electronics 20'A with VFO and VOX plugin, \$100. All fine condition. R. J. Burt, 1602 Hackett S, Beloit, Wisc. 53511.

FOR SALE: Like new B&W 6100 \$289.50. HW-12, good Condition, \$79.50. R. F. Dukes, 834 Butler St., Bolivar, Tenn. 38008.

FOR SALE: Heath phone patch model HD19 Millen KW transmatch, and Johnson SWR bridge Model 250-38. Also WRL Globe Matcher Model AT4. All mint condx. No reasonable offer refused. S. Snyder, 1839 Port Clinton Rd, Fremont, Ohio 43420.

WANTED: 500 watt Johnson for cash. Best deal. F. W. Rudolph, P.O. Box 115, Stryker, Ohio 43557.

JOIN SPAM. Society for the promotion of advanced modulation. No dues, no membership fees. Listen for W4MFU, W4ZWE, W4CAV, W4CJL, W00pc—all AM on 40 and 75. D. Hoisington, 202 Baker Dr., Florence, Ala. 35630.

TRI-EX T588 88' tower, \$150. Abt 85' 50 ohm alum coax, \$25. Will deliver within 100 miles of Reno, Nev. Paul J. Etcheberr, 1220 S. Marsh Ave, Reno, Nevada 89502.

SELL: 80-40-10 Meter Cliffdwellers Atn. Unused \$50. W. F. Mathe-meier, 935 E. Military, Fremont, Nebr. 68025.

PC Bd.famous TTL/2 TTY converter; See Sept. '67 RTTY Mag.; \$6.00 pp. J. Salter, 11040 Creekmore, Dallas, Tex. 75218.

FOR SALE: HA-10 Linear Amplifier \$150. Mint Condition. Andy Treat, 102 Sunny Circle, Mason City, Iowa 50401.

SELL: Heath SB-400 \$290. Drake 2B,2BQ,2AC, \$180. Also pair new 4-400, \$40. Pair 4CX250B, \$30. Paul Somers, 3212 Green Grove Dr. NE., Tuscaloosa, Alabama 35401.

NEW bti LK 2000 Save 75S3-400., 3251—\$400. SB200-170. F. L. Baker, Box 546, McComb, Ohio 45858.

RME 4350A receiver, best offer over \$85. Good Condition both mechanically and electrically, contact Denis Richer Jr., 433 E. 65 Terrace, K.C., Mo.

HALLICRAFTERS FPM-200 Transistorized transceiver, AC supply mobile mtng. rack, speaker, key and lock. Very gud. condition. Best offer takes it. WA0DAR/9, Marvin Gorden, 711 W. Capitol Dr., Milwaukee, Wisc. 53206.

WANTED: 2.1 and a 1.5 KC used mechanical filter for my 75A4 receiver. H. Hicks, 1911 Bermuda St., Shreveport, La. 71105.

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FOR SALE: Hallicrafters SX-62 Receiver; two lab quality adjustable, regulated power supplies—1 to +300VDC @.140 to -300VDC @.020, 6.3VDC @ 4 amp. 2 +200 to +350VDC @ .300 with meters. Make offer. R. Zuccarello, 3104 Harrison, Glenview, Ill. 60025.

BADLY need schematic for multi-elmac PMR7 receiver & AC power supply, will buy or return. Charles McGeorge, P.O. Box 1255, Cudahy, Cal. 90201.

NCX-3 mint condition, HP-23 and HP-13 power supplies. Ship FOB for \$225. W. L. Patterson, 9140 La Paloma Ave., Fountain, Valley, Cal. 92708.

WANTED: Prop pitch motor only for small prop pitch motor unit; For sale: unused RCA 813 with socket, \$12.95. R. Shongut, 25 Cameron Place, New Rochelle, N.Y. 10804.

WANTED: Carbine M-1 Cal. 30. Swap radio gear, or cash. G. H. Goldston, 1010 Burnham Rd., Bloomfield Hills, Mich. 48013.

WANTED: Ionospheric Radio Propagation (NBS Circular 462) in clean condition. S. Shallon, 11058 Queensland St., Los Angeles, Cal. 90034.

WANTED: Antique Radio Transmitting and Receiving Tubes. Made prior to 1920. S. M. La Dage, 431 Oakland Ave., Maple Shade, N.J. 08052.

FOR SALE: Heath Cheyenne and Comanche, 90 watts. 80-19 meter rcvr-xmtr, mobile mount and speaker, two 12V dynamotors for mobile supply. \$100 and U-Pay postage. D. F. Milligan, 2124 B.33rd St., Los Alamos, N.M. 87544.

SELL: Hammarlund HQ-110, in good condition, Heath GW-14 CB Transceiver with 4 xatls, never used. Both with manuals \$100 each or best offer. J. Hallock, Tilden, Ill. 62292.

WANTED: Antique radios and equipment of the early 1920's. Need not be in working condition. D. McKenzie, 1200 W. Euclid Ave., Indianola, Iowa 50125.

WANTED: 0-39/TRA-7 FSK exciter. Sell CQs, QSTs 1945 to 1955. P. Greenway, 234 Elden Dr., NE. Atlanta, Ga. 30305.

FOR SALE: Heathkit Two'er with Lawrence Eng super-het rec installed \$50 6 volt vibrator sup included. E. Marriner, 528 Colima St., La Jolla, Calif. 92037.

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WANTED: Manuals for AN/SRT-14 0-275 RFO, CHZ-60170RF monitor, and LP (General Radio) Sig Gen. R. E. Quenstedt, 512 McDonald Rd., Leavenworth, Kans. 66048.

WANTED: SX117 Rx Ok even with minor faults. Send details & price. P. Rodukoff, 21 Derby St., Hawthorne, 4171, Brisbane, Australia.

SELL 4-1000A Brand New \$50. 4X150A \$3.50.@; 6-417As Brand new \$2.75@. Send SASE for List. R. Zurawski, Rt. 1 Box 184, Melmoninee, Mich. 49058.

WANTED: KWM-2 or KWM-2A manufactured since Jan. 1966. Accessories, Col. Heinlen, 107 Wyoming St., Boulder City, Nev. 89005.

FIRST twenty bucks takes good Knight Signal Generator. 0.16—112 MHz. range. Postpaid. Don Meadows, 2227 Booth Ave., Marysville, Cal. 95901.

A MUST for every home and office. A national zip code directory. \$1 postpaid to you. R. A. Weigand, 177 S. Union Ave., Salem, Ohio 44460.

SELL NC125 \$55. Globe V10 VFO \$30 Chief 90 \$20 or trade/cash for ac tape recorder (\$80 range) R. Wilson, 114 Grand Ave., Storm Lake, Ia.

COLLINS VFO 70-E12,2555-355kc, unused, w/dial drive (CQ Nov. '65) \$35. LM-17 orig. cal.bk.w/PS \$50. H. Lowenstein, Short Hills Terr Apt. 4E, 806 Morris Turnpike, Short Hills, N.J. 07078.

ESTATE SALE Viking II xmtr w/VFO, Globe Scout 680A, HRO RCVR w/coils, Warrior linear, Eico 720 xmtr, many other items ham gear & test equipment. Write W. Goff, 5 Addoms St, Plattsburgh, N.Y. 12901 for list.

FOR SALE: Wheatstone oiled 15/32" perf tape for Boehme keying head, any quantity. P. L. Lemon, 3154 Stony Pt. Road, Santa Rosa, Cal. 95401.

FOR SALE: KWM-2, Mobile Mount, with noise blanker, DC Power supply, 80-10 new newtronics mobile antennas. Best offer. J. Popkin-Clurman, 134 Wheatley Road, Brookville, Glen Head, N.Y. 11545.

EXTREMELY CLEAN Sb-400 \$280. (unused for the past year). Special 6 volt HP-13 Mobile Supply for Volkswagen \$50. New heath HR-10 RX \$70. QST's May '55 thru Dec. '66 \$40. Much more—Stamp for list. J. Shank, 21 Terrace Lane, Elizabethtown, Pa. 17022.

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WANTED: your old vacuum tubes, need TB-1, VT-13, VT-14, UV213, UV216, UV203, WE211D, 212D, 1A, Welsh 501, National Rectobulb, 1917 British "R" tube. Telefunken EVN194, ER58, EVE193, and others. R. W. Schnedorf, 610 Monroe Ave, River Forest, Ill. 60305.

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VIKING Challenger, gud condx, \$50; HG-10 VFO, \$25; Mint Heath HR-10 with xtal cal., \$60; \$120 takes all. Wrked WAS/WAC with this rig. R. Herold, P.O. Box 383, Myrtle Beach, S.C. 29577.

NOVICE Station: Eico 720, Hallicrafters Sx-99, Knight R-100, Long Wire Antenna. Want 6 meter gear and beam. Best offer accepted. R. Hajdak, 4 Homer St., Greenville, Pa. 16125.

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DRAKE TR-4, AL-3, \$495; Collins 75S-1, Waters Reveltion, 2.1 + 1.5 Filters, \$295; HQ170C \$175; Mint, Trade. D. M. Burns, 4410 Reading Road, Dayton, Ohio 45420.

FOR SALE: Swan 350, xal cal., select. Sideband, Model 22 adaptor, plug-in vox, AC Power, Capt. Wirstrom, 2506 Church St., Selma, Alabama 36701.

BC 221 N with internal AC supply and book 1-1 \$65. Iverson, 2640 So. 133rd, Seattle, Wash. 98168.

MONITORADIO M160, 12V, 152-174 mc FM Rcvr. \$65 ACps \$10. GE, xtal, batt portable 152-174mc FM Rcvr, Sq, 1 1/2 x 6 x 7 \$45 both perf w/manuals & ants. T. Perera, 410 Riverside Dr., N.Y. 10025.

WANTED: Volume #1 to Volume #6 of CQ. Will swap QST for them. Need old QST before 1932. E. Guimares Jr., 17 West End Ave., Middleborough, Ma. 02346.

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HELP WANTED—I need one instruction book for Receiver R-390A/URR and oscilloscope OS-34/USM-32. E. J. Someas, 227 Ave. DU Bois De La Cambae-Baussels 5 Belgium.

SELL: Eico Model 710 Dipper—\$40. Model 715 TransMatch \$42. Mercury Model 120 Tube Tester \$40. Perfect & New. F. Cooper, 8258 Brittany Pl., Pittsburgh, Pa. 15237.

FOR SALE: Swan 350, New Jan 66, xal cal, selectable sideband model 22. VFO Adaptor plug in vox, AC power supply \$375. Capt. Wirstrom, 2506 Church St., Selma, Alabama 36701.

FOR SALE: Heath HG-10 VFO Excellent condition \$25. You pay shipping. G. J. Cotellis, 1903-32nd St., W. Bradenton, Fla. 33505.

WANT offers: NC183D very clean w/Prod-det/Man, National 200 & PS nearly new, T-90 & HB PS. I-177 w/man/HB adapt. Jackson Mod-715 T.T.A. S. Johnson, 594 Alderson St., El Cajon, Cal. 92021.

CANADIANS: wang sig-gen model 80 or similar. Collins 51S-1, Racal 71, HRO 500 or similar. R. H. Fransen, Box 197, Sherwood Park, Alberta, Canada.

SX-111 Hallicrafters Receiver. Original owner will ship. Original operating condition. First certified check \$115 takes. Paul Baumgartner, Williamson, West Virginia 25661.

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FOR SALE: HFS with pwr \$75, PWR7 with DC PWR \$40, Elmac 54A #15, Ex Signal Shifter with Phase modulator \$15. R. Hobbs, 960 W. Milton, Alliance, Ohio 44601.

ANTIQUE HRO rcvr, pwr supply, coil case; rack mount. Make offer. Carl C. Drumeller, 5824 N.W. 58 St., Oklahoma City, Oklahoma 73122.

SELL: 1RE Proceedings—'42 thru '66 RCA Review—'46 thru '66. Make offer—you pay shipping—H. Marrianan 312, Wildewood Terr. Oklahoma City, Okla. 73105.

CANADIANS: for sale; 32VI \$200. DX100 \$125. SX71 \$140. Scopes H010 \$75. 425 \$50. eico 377 audio gen. \$30. J. Braendle, Binscarth, Manito Canada.

SHAWNEE for sale \$100, also 2M communicator I and SCR522 Tr with RA62-CPS Send SASE for details. Green Bank, W. Va. 24944 C. C. Babe.

WANTED Instructograph and wireless code tapes. C. Fouse, P.O. Box 2, Wash. W. Va. 26181.

SACRIFICE: Knight T-150A xmtr excel cond, \$60. Lafayette starflite 90 Watt xmtr good cond, \$25. Both FOB * Steve Kopstein, Oxford, Wis. 53952.

WANTED: ATKO Mini-Keyer, Model 10A or 10B. Lt. Brodnax, P.O. 414, Hamilton, AFB, CA. 94935.

WANTED: 32S3 and pwr supply. also 388 o 390 receiver; cash no trades C. Kaufman. 231 So. Jasmine S. Denver, Colo. 80222.

FOR SALE: HT-44 xmtr ssb-200 Watts with p-1500 ac power supply. New \$295. Money order or cashiers check Shipped FOB. J. Ashley, Box 254, Ware Shoals, SC 29692.

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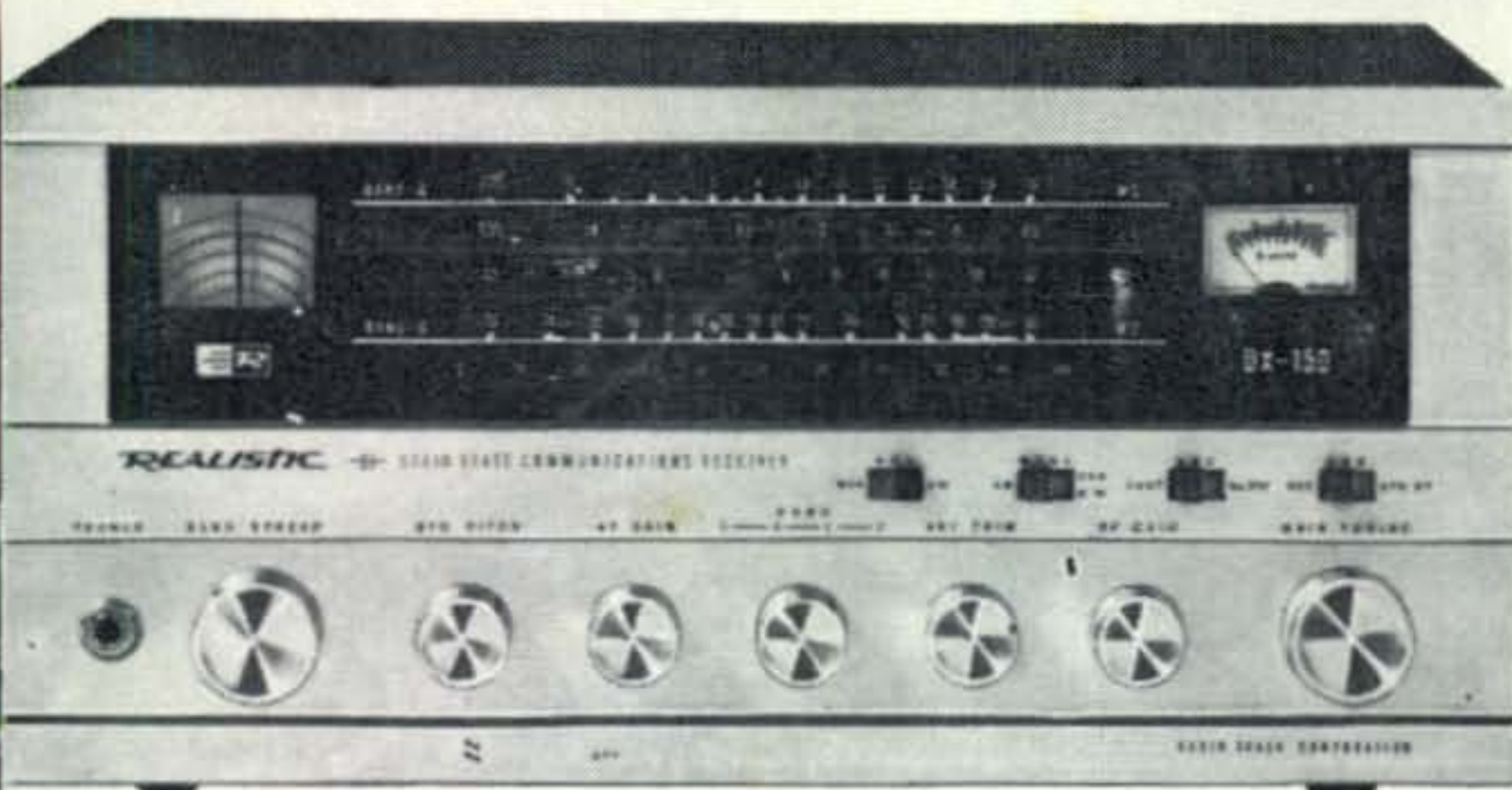
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R.S. #	ADVERTISERS INDEX	PAGE
1	Adelphi Electronics	57
2	Aerotron, Inc.	49
3	Alltronics-Howard Co.	104
4	AlvaRadio	103
5	Amateur Electronic Supply, Inc.	45
6	Amber Industrial	105
7	Antenna Specialist	64
8	Arnold's Engraving	113
9	Arco Mfg. Co.	111
10	Arcturus Electronic Corporation	103
11	Astatic Corporation	63
12	Barry Electronics	106
13	Burton-Rogers Company	106
14	Cleveland Institute of Electronics	17
15	Cleveland Institute of Electronics	109
16	Clegg, E. T. & Associates	112
	Collins Radio	Cover II
17	Comdel, Inc.	73
	Communications Components Company	106
18	Community Electronics	106
19	Dow Key Company	114
20	DPZ Corporation	62
21	Drake, R. L. Company	59
22	Dynalab	110
23	Eimac, Division of Varian	4
24	ESSCO	26
25	Evansville Amateur Electronic Supply Co.	31
26	E-Z Mobile Mounts	114
	Fair Radio Sales	106
27	Galaxy Electronics	122
28	Gateway Towers	115
	G & G Radio Sales	103
29	Goodheart, R. E., Co., Inc.	104
30	Gordon, Herbert W., Company	82
31	Gordon, Herbert W., Company	83
	Gotham	128
32	Hafstrom Associates	116
33	Hallicrafters	2
	H & L Associates	105
34	Heath Company	43
35	Henry Radio	25
36	Henry Radio	99
37	Hotel Sahara	55
38	Hunter Sales	113
39	Hy-Gain Antenna Products Company	69
40	Instructograph Company	114
41	International Crystal Mfg. Co., Inc.	1
42	Jackson Rubber Stamp & Supply Co.	115
	Jan Crystal	106
43	Knight Radio	115
	Lampkin Laboratories	115
	Leeds Radio	103
	Lewispaull Electronics, Inc.	104
44	Liberty Electronics, Inc.	105
	Midway Antenna	108
	Military Electronics Corp.,	
	Space Electronics Division	104
45	Millen, James, Mfg. Co. Inc.	10
46	Mosley Electronics, Inc.	24
47	Multicore Sales Corp.	112
48	Music Associated	108
49	New-Tronics Corp.	42
50	Omega-T Systems	113
51	Partridge Electronics, Ltd.	109
52	Pennwood Numechron Company	111
53	Petersen Radio Company, Inc.	111
	Radio Amateur Callbook Inc.	108, 116
	Radio Officers Union	115
	Radio Shack	121
	RCA Electronic Components and Devices	Cover IV
55	Rohn Manufacturing Co.	9
	Sentry Electronics	7
56	Slep Electronics	106
57	Squires-Sanders, Inc.	74
58	Swan Electronics Corp.	65
59	Telrex Communication Engineering	
	Laboratories	111
60	Telrex Communication Engineering	
	Laboratories	115
61	Tepabco	113
62	Vanguard Electronic Labs.	109
63	Vanguard Electronic Labs.	110
64	Vibroplex Co., Inc., The	113
65	Waters Manufacturing, Inc.	38
66	Waters Manufacturing, Inc.	39
67	WRL World Radio Laboratories, Inc.	11
68	WRL World Radio Laboratories, Inc.	Cover III

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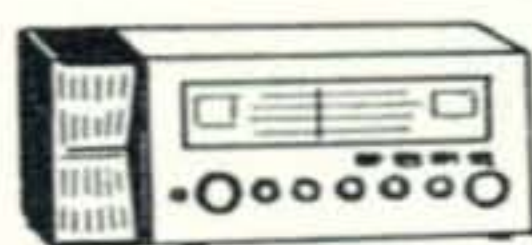
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Index to CQ Vol. 23-1967

ANTENNAS, TOWERS, TRANSMISSION LINES

All-Around Dipole, The (Schultz, W2EEY/1)	64, Jan.
AN/PRD-7 Surveillance Antenna (SURPLUS)	92, Oct.
ARM-160-5 Log Periodic Antenna (SURPLUS)	102, Dec.
Designing and Building A Five-Band Apartment-Size Antenna (Lowenstein, W2HWH)	46, Dec.
Do-It-Yourself Beam, The (Smith)	43, Nov.
Evaluating An Antenna (Glanzer, K7GCO)	80, July
Feedline Tuning-Unit for 80, 40 and 20 Meters (Marriner, W6BLZ)	48, Oct.
First Quad (La Farra, W5ZCC)	51, Dec.
Future For Coaxial Cables, The (Briskman, K2IEG)	33, March
Half Wavelength DDRR Antenna, The (Horn, IIMK)	12, Sept.
High Frequency Horn Antenna, A (Schultz, W2EEY/1)	65, March
Laud Shorty On the Bottle (Paddon, G2IS)	56, Sept.
Log Periodic Antennas (Brogdon, K3KMO) Part I	81, Oct.
Part II	80, Nov.
Mark IV DX Antenna, The (Lee, W3JHR)	60, Feb.
Measuring Coaxial Line Loss (Glanzer, K7GCO)	76, Aug.
Miniaturized Antennas (Schultz, W2EEY/1) Part I	16, Nov.
Part II	33, Dec.
Monoband Coaxial-Fed 50 Ohm Thick Dipoles (Turner, W4MND)	54, Nov.
Portable Suction Cup Antenna, A (Schultz, W2EEY/1)	72, Aug.
Self-Resonant Two Element Beam, The (Elwell, Jr., W2JKH)	58, June
Shortened 40 Meter Vertical, A (Lumachi, WB2CQM)	35, July
Six-Meter J Antenna, A (Kretzman, W2JTP)	29, Dec.
Ten Meter Colinear Array, A (Marriner, W6BLZ)	25, May
Test Models for H.F. Antennas (Smith)	38, Oct.
Versatile Antenna Tuner, A (Fullinwider, W5PSA)	48, Sept.
5/8 Wave Vertical Antenna for 440, A (Kretzman, W2JTP)	49, March

AUDIO AMPLIFIERS—MODULATION

Compressor, The (Schultz, W2EEY/1)	65, June
Match Patch, The (La Farra, W5ZCC)	82, Aug.
More Watts Per Dollar—AM-864/U Compressor Amplifier (Lee, W3JHR)	68, Aug.
3-Transistor Audio Compressor, A (Lee, W3JHR)	75, July

COMMERCIAL EQUIPMENT REVIEWS

Clegg 66'er 6-Meter Transceiver, CQ Reviews: The	68, Sept
--	----------

Drake 2-C Receiver, CQ Reviews: The	32, June
Eico Model 717 Electronic Keyer, CQ Reviews: The	19, May
Galaxy 2000+ Linear Amplifier, CQ Reviews: The	17, Jan.
Hallicrafters HT-46 S.S.B. Transmitter, CQ Reviews: The	47, Aug.
Hallicrafters SR-2000 Hurricane Transceiver, CQ Reviews: The	54, March
Heath HW-16 Novice C.W. Transceiver, CQ Reviews: The	18, Dec.
Knight-Kit Regulated Power Supplies, CQ Reviews: The	49, Nov.
National 200 Transceiver, CQ Reviews: The	52, Feb.
Omega-T Systems Antenna Noise Bridge, CQ Reviews: The	58, Oct.
Swan 250 6-Meter S.S.B. Transceiver, CQ Reviews: The	57, July
Waters Dummy Loads and Wattmeter Models 374 and 384, CQ Reviews: The	56, Apr.
Waters "Protax" Coaxial Switches, CQ Reviews: The	55, Apr.
Waters Wide Range Attenuator, CQ Reviews: The	40, Nov.

COMMERCIAL EQUIPMENT MODIFIED

A.M. Operation With the Heath SB-110A (Scherer, W2AEF)	75, Aug.
Convert Your Ranger I for Six-Meter Operation (Oras, W9ZEW)	79, Aug.
C.W. Conversion For The Heathkit HW-Series Transceivers (Schultz, W2EEY/1)	36, Feb.
Do-It-Yourself Increment Tuning (Dezettel, W9SFW)	45, Oct.
How To Improve Your SB-34 Transceiver (Marriner, W6BLZ)	50, Apr.
Improving The Eico 753 Transceiver (Logan, WB2FBF)	14, July
Improving The 75S-1 On 10 & 15 (La Farra, W5ZCC)	49, Jan.
Fast-Tuning Spinner Knob, A (Scherer, W2AEF)	61, Aug.
Modifying The Swan 350 For A.M. Reception (Brasure, W2ZFE)	48, Apr.
More Versatility for the Heath HA-14 Linear (Schultz, W2EEY/1)	68, July

CONTESTS and OPERATING

All Asia Contest, 1966 Results	96, Aug.
All-Time Records: CQ W.W. DX Contest	64, Sept.
CQ 9th Annual 160 Meter C.W. Contest, Announcing	89, Dec.
CQ 1967 Twelve Hour VHF Contest, Announcing The	36, Apr.
CQ 1966 W.W. SSB DX Contests Results	51, Jan.
CQ 1967 W.W. SSB Contest, Announcing	64, March
CQ 1966 W.W. DX (C.W.) Contest, Results	46, July
CQ 1966 W.W. DX (Phone) Contest Results	40, June

CQ 1967 W.W. DX Contest, Rules	59, Sept.
Helvetia 22, 1966 Results	83, May
OZ CCA Contest, 1966 Results	83, May
Station-Within-A-Station "Stars" During Chicago Blizzard	62, Apr.
Time Simplified (Chapin, W8GVW)	43, Feb.
USA-CA Rules and Program	85, Feb.
USSR DX Contest, 1966 Results	83, May
WAZ Rules—Complete (DX)	89, Aug.
WPX Rules—Complete (DX)	90, Aug.
8th Annual CQ 160 Meter DX Contest, Results (O'Brien, W2EQS)	52, Oct.
27th Annual YLRL Anniversary Party, Results of the	70, Apr.
1966 WAE DX Contest Results	77, Apr.
1967 Armed Forces Day Communications Tests, Announcing	49, May

DX AND DXPEDITIONS

County Hunting On The Move (Kahn, W8DUS)	26, Aug.
FP8AS Calling . . . (O'Brien, W2EQS)	60, Jan.
Let's Clear The Air About Rockall! (Margolis, G3UML)	64, May
Most Wanted DX Countries (dx)	74, Apr.
"Randi" Expedition to Peru	54, May
W9GIL DX Survey (dx)	72, Apr.
W9WNV-DXCC Committee Conflict: DX World Opinion(dx)	71, May

HAM CLINIC/SIMON SAYS

HAM CLINIC—Page 84, Jan.	
A.C. Line Regulation	
BC-610 TVI	
Building vs. Buying	
CB and The Ham Technician	
FET R.F. Amplifier	
F.M. ing in The SB-33 (SF-1 Series)	
HRO-500 Rough Audio	
NCX-3 Chirp	
Novice Problem	
HAM CLINIC—Page 78, Feb.	
Discussion: Thoughts On Saving Amateur Radio	
HAM CLINIC—Page 85, March	
A.F. Signal Generator	
Another Transistor Q-Multiplier	
Cooler 75A-4	
C.W. Monitor	
Drake 2A Noise Limiter	
G-G 813's	
Q-Multiplier for High I.F.'s	
Scope Matching	
Simple S.S.B. Detector	
Squelch	
Tuneup Indicator	
6 Meter Mobile Hash Trap	
SIMON SAYS—Page 85, April	
Collins vs. Heath	
Ham TV (ATV)	
Heathkit Comanche MR-1	
Matching 412 ohms to 50 ohms	
No 50kc Source	
SCR-522	
SIMON SAYS—Page 84, May	
Broadband Preamp	
Directional Wattmeter 100 mh Chokes	
Osc. Feedthrough On 6 m. Trans. Conv.	
R.F. Breakdown	
Stability Factor	
6-Meter TVI	

SIMON SAYS—Page 85, June

High-Pass Filters
Pi-Networks Design
Voltage Reduction With A Capacitor

SIMON SAYS—Page 104, July

MARS Operation With Tri-Band Beams
Surface Area of Quads

SIMON SAYS—Page 102, Aug.

Ceramic Capacitor Positions
Eico Model 753-1 Transceiver Cures
Expensive Lorch Receiver
Gold-Line Signal Hunter as R.D.F.
Rust Proof Antenna Mount
Scope Monitor Connections
1:1 Baluns
1500 Watt Average OK With FCC

HUMOR and FICTION

DXing The Galaxy On 633×10^{-10} Meters (Gupton, Jr., W4AML)	56, Dec.
Infiltration Affair, The (Daughtrey)	66, Aug.
I Was A Fugitive From An Electronics Magazine (Kneitel, K2AES)	32, May
Like A Hole In Our Head (Margolis)	53, June
Man From H.U.N.G.E.R., The (Weisman, W1VIV)	61, Sept.
Not On Our Transmitter You Don't Say "Drop Dead" (Margolis)	37, March
Pussy Cat, Pussy Cat, Where Have You Been? (Margolis)	47, Feb.
Some Day We'll Build A Home On A Hilltop High, You and I . . . (Margolis)	86, July
Special Subscriber Service (Ostermond-Tor, Ex-YM4XR)	24, Apr.
"The British Were Here, The British Were Here. . . !" (Margolis)	57, Nov.
"Visiting Firemen and the Good Old Days" (Margolis)	75, Dec.
Whip Crack Away (Margolis)	40, Aug.

KEYING, KEYERS and CONTROL CIRCUITS

Automated C.W. (Jones, K3AAY)	32, Feb.
Eico Model 717 Electronic Keyer, CQ Reviews: The	19, May
Glo-Key, The (Jackson, VE3QQ)	14, May
High Speed Automatic Morse Equipment (SURPLUS)	108, Aug.
Integrated Circuit Code Practice Oscillator (Sack, W3NRG)	57, Jan.
Integrated Keyer, The (Burchfield, W8CRD)	12, Dec.
Keying Monitor In The Key, A (Schultz, W2EEY/1)	87, Sept.
Nick-Key, An Electronic Keyer, The (Nichols, W6JJI)	58, Feb.
Optimize Your Touch-Key (Jackson, VE3QQ)	47, March
Simple Semi-Break-In System for Phone and C.W. (Fast, WA1EBU)	45, May
Solid State CWX (Hyder, K7HQN)	14, Oct.

MISCELLANEOUS: GENERAL

Annual Radio Electronic Convention For The Blind	80, Dec.
Conversation With A Novice (Aurick, K3QAX/W2QEX)	38, Apr.
"Designed for Application;" The Story of James Millen, W1HRX (Plant, K9LAJ/2)	26, July
Sail To Glory	51, Sept.

Do You Know The Phillips? (Pyle, W7OE)	55, Jan.
Electronics Careers: Is There One In Your Future? (Pyle, W7OE)	
Part I: Crashing The Gate	22, Sept.
Part II: Opportunities Unlimited	33, Oct.
Part III: Choosing An Electronics School	65, Nov.
International Mission Radio Association News (Cox, W2CBX)	71, Jan.; 72, Feb.; 26, March; 31, Apr.; 46, May; 61, June; 73, July; 44, Aug.; 30, Sept.
LA1ITU: From The Land of the Midnight Sun (Jacobs, W3ASK)	74, Oct.
Le Chatelier and the C.B.'ers (Wagner, G3BID)	71, Apr.
My Quarter Of A Million Friends (Johnson)	68, Feb.
Need QSO's Be Dull? (Wagner, G3BID)	78, Nov.
Quarter Century Wireless Association Celebrates It's 20th Anniversary (Di Blasi, W2FX)	68, Apr.
Radical Proposal, A (Soifer, K2QBW)	19, Feb.
Text of F.C.C.'s Decision on Incentive Licensing	27, Oct.
What's Your Junk Box I. Q.?	48, Nov.
Wireless Before 1900 (Marriner, W6BLZ)	66, Jan.
\$5000 For The Future—Revisited Rogers, WA5NBB & Clampit, K5TCK)	60, Apr.

MISCELLANEOUS—TECHNICAL

AN/TXC-1 Facsimile Transceiver (SURPLUS)	88, Jan.
Field-Effect Tube, The	28, Jan.
Finger-Tip Coax Switches (Scherer, W2AEF)	42, May
Future For Coaxial Cables, The (Briskman, K2IEG)	33, March
Lightning — Atmospheric Electricity (Simons, WB6LAS)	28, June
Mutual Radio Communication Service Interference (Costa)	52, Sept.
Narrow Band, The Next Step After Sideband? (Schultz, W2EEY/1)	
Part I	42, March
Part II	46, April
Photographing Electronic Gear (Scherer, W2AEF)	26, Nov.
Piezoelectric Filters (Tartas, W2YKT)	14, June
Real Cool Cooling and Silver Plating (Cook, WA2RDO)	34, Jan.
Simple Etched Circuit Boards (Lowenstein, W2HWH)	17, Sept.
Skin Effect In High Frequency Design (Tartas, W2YKT)	34, Apr.
Thin Film Techniques, A Primer of (White)	40, July
Time Simplified (Chapin, W8GVW)	43, Feb.
Ultimate In Automobile Alarms, The (Crawford, WA4SAM)	29, Apr.
Weather Satellite Pictures, IIPDN and I1DV Copy Italy's Only (Scherer, W2AEF)	28, March

POWER SUPPLY

Line Voltage Regulation, The Importance of (Logan, WB2FBF)	42, Oct.
Power Generator Frequency Meter	

(White)	46, Feb.
Tuned Choke Input (Brown, W6HPH)	80, Oct.
Utility Transceiver Power Supply (Schultz, W2EEY/1)	58, Jan.

RADIOTELETYPE

AN/TXC-1 Facsimile Transceiver (SURPLUS)	88, Jan.
Model 28 Teletype System (SURPLUS)	92, Feb.
Model 28 Teletype Tape Equipment (SURPLUS)	90, May
TDA RTTY Distortion Monitor Scope (SURPLUS)	106, Nov.
Teletype Corp. Model 32KSR (SURPLUS)	95, June
Western Electric 314-A Polar Relay (SURPLUS)	94, June

RECEIVERS and RECEIVING

Command Set Receivers for All Frequencies —The Easy Way (White)	21, Jan.
Companion, A Homebrew Matching Receiver for the Heath SB-400 S.S.B. Transmitter, The (Hulick, W9MIJ/1)	12, Apr.
Crystal C.W. Filters With Diode Switching (Schultz, W2EEY/1)	33, Nov.
Diode R.F. Attenuator, The (Schultz, W2EEY/1)	59, Aug.
Do-It-Yourself Increment Tuning (Dezettel, W9SFW)	45, Oct.
F.E.T. Product Detector, An (Schultz, W2EEY/1)	32, July
Fixed Frequency Weather Broadcast Receiver (Ives)	19, June
Improving The 75S-1 On 10 & 15 (La Farra, W5ZCC)	49, Jan.
Low Band Converter, A (Sondgeroth, W9ZTK)	18, Oct.
Modifying The Swan 350 For A.M. Reception (Brasure, W2ZFE)	48, Apr.
Mast Mounted F.E.T. Pre-Amp, A (Schultz, W2EEY/1)	62, Aug.
Noise Generators (Schultz, W2EEY/1)	31, Jan.
Omniverter, The (Scherer, W2AEF)	
Part I: Design and Performance	12, Feb.
Part II: Construction	14, March
Part III: Alignment	65, Apr.
Panoramic Adaptor Converter, A (Kupferman, W2GVT)	61, Oct.
Product Detector For Military Receivers, A (Owings, KØAND)	67, Mar.
Surplus Panadaptor Roundup (SURPLUS)	102, Dec.
V.H.F. ARC-5 Type Receivers (SURPLUS)	90, March
2.1 Kc Filter for the 75A-4, (Drozdzick, W1NBM)	22, July
25 Kc Multivibrator, A (Scherer, W2AEF)	26, Dec.
40 Meter QRP S.S.B. Transceiver, A (Walrod, VE7BRK)	12, Aug.
40 Meter "Wee-Ceiver", A (Weaver, WB2HAL)	23, Oct.

SEMICONDUCTORS

Compressor, The (Schultz, W2EEY/1)	65, June
Diode R.F. Attenuator, The (Schultz, W2EEY/1)	59, Aug.
F.E.T. Product Detector, An (Schultz, W2EEY/1)	32, July
Integrated Circuit Code Practice Oscillator (Sack, W3NRG)	57, Jan.

Integrated Keyer, The (Burchfield, W8CRD)	12, Dec.
Low Band Converter, A (Sondgeroth, W9ZTK)	18, Oct.
Mast Mounted F.E.T. Pre-Amp, A (Schultz, W2EEY/1)	62, Aug.
Piezoelectric Filters (Tartas, W2YKT)	14, June
Practical Uses of Voltage Variable Capacitors (Schultz, W2EEY/1)	81, Sept.
Small Signal Transistor Tester, A (Turner, W4MND)	70, Dec.
Solid State CWX (Hyder, K7HQH)	14, Oct.
Thin Film Techniques, A Primer of (White)	40, July
Use of Integrated Circuits in Receivers and Transmitters (Schultz, W2EEY/1)	36, May
3-Transistor Audio Compressor (Lee, W3JHR)	75, July
40 Meter QRP S.S.B. Transceiver, A. (Walrod, VE7BRK)	12, Aug.

SPACE COMMUNICATIONS

AUSTRALIS—OSCAR Arrives in U.S.	32, Aug.
EURO—OSCAR: A Status Report	25, July
EURO—OSCAR Satellite Favored to Win OSCAR 5 Race (Jacobs, W3ASK)	23, May
Jansky or Reber Father of Radio Astronomy?	35, May
Project MOONRAY: Announcement	18, July
Project MOONRAY: Parameters	44, Dec.
Project OSCAR: A Progress Report (Jacobs, W3ASK)	69, March
Signals From Space—Grote Reber Story (Brown, K2QSZ and Katz, K2UYH) ..	60, March
Table of Transmitting Satellites (Jacobs, W3ASK)	29, Jan.
Weather Satellite Pictures, IIPDN and IIDV Copy Italy's Only (Scherer, W2AEF) ..	28, March

SURPLUS

AN/PRD-7 Surveillance Antenna (SURPLUS)	92, Oct.
AN/TXC-1 Facsimile Transceiver (SURPLUS)	88, Jan.
ARM/160-5 Log Periodic Antenna (SURPLUS)	102, Dec.
BCS-1A Bliley Frequency Standard (SURPLUS)	112, Nov.
Command Set Receivers for All Frequencies—The Easy Way (White)	21, Jan.
FR-67/U Berkeley Frequency Counter (SURPLUS)	102, Dec.
High Speed Automatic Morse Equipment (SURPLUS)	108, Aug.
MBF Collins VHF Transceiver (SURPLUS)	97, Oct.
Model 28 Teletype Equipment, The (SURPLUS)	90, May
More Watts Per Dollar—AM-864/U Compressor Amplifier (Lee, W3JHR)	68, Aug.
MRT-9 Bendix "Packset" (SURPLUS)	108, Sept.
Product Detector For Military Receivers, A (Owings, K0AHD)	67, March
Simple ARC-5 V.F.O. Conversion, A (Diodati, K3PXT)	41, Apr.
Surplus Panadapter Roundup (SURPLUS) ..	102, Dec.
TDA RTTY Distortion Monitor Scope (SURPLUS)	106, Nov.
TDQ Transmitter (SURPLUS)	92, June
V.H.F. ARC-5 Type Receivers (SURPLUS)	90, March

V.L.F. Receivers from Surplus (SURPLUS) ..	88, Apr.
Western Electric 314A Polar Relay (SURPLUS)	94, June

TEST EQUIPMENT and MEASUREMENTS

BCS-1A Bliley Frequency Standard (SURPLUS)	112, Nov.
Ferret for Harmonics, A (Tellefsen, W0KMF)	63, Oct.
FR-67/U Berkeley Frequency Counter (SURPLUS)	102, Dec.
Noise Generators (Schultz, W3EEY/1)	31, Jan.
Panoramic Adaptor Converter, A (Kupferman, W2GVT)	61, Oct.
Power Generator Frequency Meter (White)	46, Feb.
Small Signal Transistor Tester, A (Turner, W4MND)	70, Dec.
Sub-Harmonic Crystal Oscillators (Brown, W6HPH)	37, June
Supercalifragilistic Supersimplescope, The (Townsend, WA4DCN)	11, Nov.
Surplus Panadapter Roundup (SURPLUS) ..	102, Dec.
TDA RTTY Distortion Monitor Scope (SURPLUS)	106, Nov.
Tuning Indicator for S.S.B. Amplifiers (Orr, W6SAI)	33, May
Understanding Tube Testers (Schleicher, W9NLT)	59, May
Voltmeter Circuit Loading (Fincutter, K3STU) Part I	75, Sept.
Part II	66, Oct.
25 Kc Multivibrator, A (Scherer, W2AEF)	26, Dec.

TRANSMITTERS and TRANSMITTING

All Band C.W. Transmitter With Grid Block Keying, An (Rudin, W9IZF/W1WSN) ..	39, Feb.
Automatically Tuning The Linear Amplifier (Sherrod, W5ZG)	34, Aug.
Cookstone Linear, The (Hallam, W5PKS) ..	45, Jan.
Crystal Control For The Top Band S.S.B. Transmitter Carrier Oscillator (Genaille, K4ZGM)	74, Nov.
C. W. Conversion For the Heathkit HW-Series Transceivers (Schultz, W2EEY/1)	36, Feb.
Field-Effect Tube, The	20, Jan.
LS-240 6 M. Transmitter, The (Plant, K9LAJ/2)	27, May
More Versatility for the Heath HA-14 Linear (Schultz, W2EEY/1)	68, July
Poor Man's 6-Meter Special, The (Kelly, W6JTT)	66, Dec.
Power Boost for the Ultimate Exciter, A (Lee, W3JHR)	51, May
Pre-Tuning the Linear Amplifier (Coss, W4RND)	49, June
Shoobox II Linear, The (Schultz, W2EEY/1)	76, July
Simple ARC-5 V.F.O. Conversion, A (Diodati, K3PXT)	41, Apr.
Simple Multi-Function Tuning Aid, A (Schultz, W2EEY/1)	66, July
Top Band S.S.B. Transmitter, A (Genaille, K4ZGM)	33, Sept.
Tuning Indicator for S.S.B. Amplifiers (Orr, W6SAI)	33, May
Ultimate S.S.B. Exciter, The (Lee, W3JHR)	24, Feb.

2 Kilowatt 3-400Z Linear for Six Meters, A (Orr, W6SAI)	12, Jan.
3.5 Mc Vacuum Tube V.F.O., A (Marriner, W6BLZ)	40, Dec.
40 Meter QRP S.S.B. Transceiver, A (Walrod, VE7BRK)	12, Aug.
80 Meter S.S.B. Transmitter, Old Reliable—An (Marriner, W6BLZ)	36, Jan.

V.H.F. and U.H.F.

Bendix MRT-9 "Packset" (SURPLUS)	108, Sept.
Convert Your Ranger I for Six-Meter Operation (Oras, W9ZEW)	79, Aug.
LS-240 6 M. Transmitter, The (Plant, K9LA/2)	27, May

MBF Collins VHF Transceiver (SURPLUS)	97, Oct.
Microwave and the Amateur (Kretzman, W2JTP)	53, Aug.
Poor Man's 6-Meter Special, The (Kelly, W6JTT)	66, Dec.
Six-Meter J Antenna, A (Kretzman, W2JTP)	29, Dec.
Test Models for H.F. Antennas (Smith)	38, Oct.
V.H.F./U.H.F. Exploration (Carey, ZE5JJ)	71, Oct.
5/8 Wave Vertical Antenna for 440, A (Kretzman, W2JTP)	49, March
2 Kilowatt 3-400 Z Linear for Six Meters, A (Orr, W6SAI)	12, Jan.
11,000 Miles Spanned On 144 Mc (Brown, K2ZSQ)	25, Jan.

GOTHAM'S AMAZING ANTENNA BREAKTHRU!!

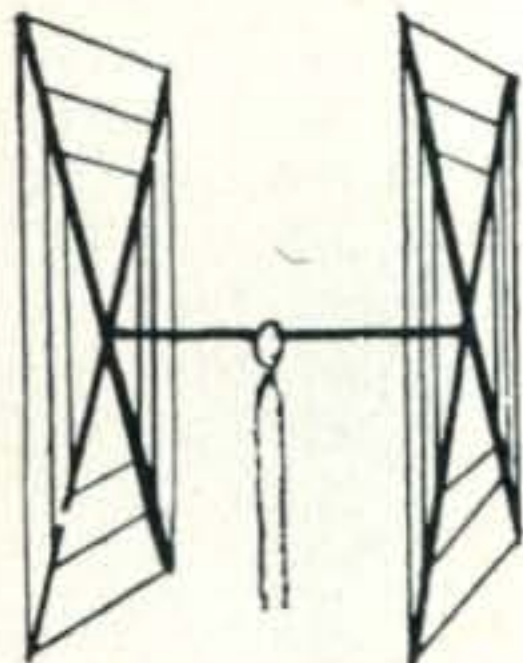
How did Gotham drastically cut antenna prices? Mass purchases, mass production, product specialization, and 15 years of antenna manufacturing experience. The result: The kind of antennas you want, at the right price!

QUADS Worked 42 countries in two weeks with my Gotham Quad and only 75 watts...

W3AZR CUBICAL QUAD ANTENNAS — these two element

beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam

mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!



10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad

Number of Elements: Two. A full wavelength driven element and reflector for each band.

Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.

Shipping Weight: 28 lbs. Net Weight: 25 lbs.

Dimensions: About 16' square.

Power Rating: 5 KW.

Operation Mode: All

SWR: 1.05:1 at resonance

Gain: 8.1 db. over isotropic

F/B Ratio: A minimum of 17 db. F/B

Boom: 10' long x 1 1/4" O.D.; 18 gauge steel; double plated; gold color

Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064" diameter.

X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping 7/8" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished); 52 ohm coaxial cable

Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	\$35.00
10-15 CUBICAL QUAD	30.00
15-20 CUBICAL QUAD	32.00
TWENTY METER CUBICAL QUAD	25.00
FIFTEEN METER CUBICAL QUAD	24.00
TEN METER CUBICAL QUAD	23.00
(all use single coax feedline)	

BEAMS The first morning I put up my 3 element Gotham beam (20 ft) I worked

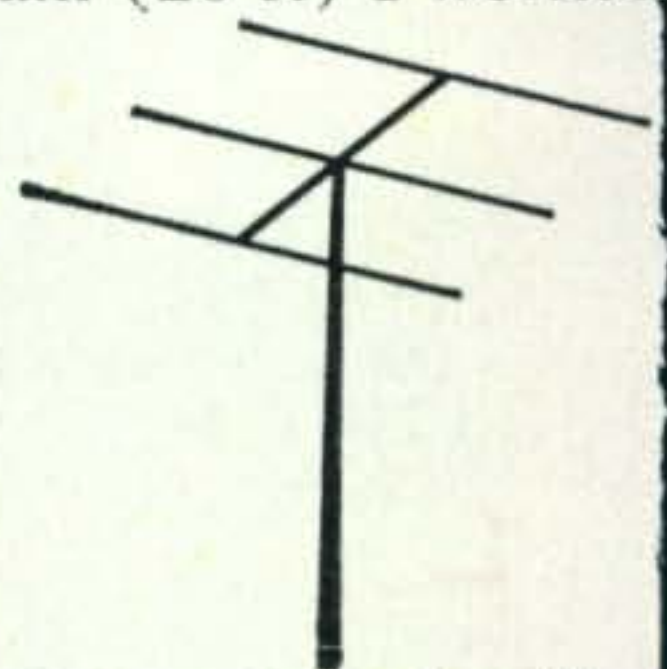
YO4CT, ON5LW, SP9-

ADQ, and 4U1ITU.

THAT ANTENNA

WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!

Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; 7/8" and 1" aluminum alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.



2 EL 20	\$16	4 EL 10	\$18
3 EL 20	22*	7 EL 10	32*
4 EL 20	32*	4 EL 6	15
2 EL 15	12	8 EL 6	28*
3 EL 15	16	12 EL 2	25*
4 EL 15	25*	*20' boom	
5 EL 15	28*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2ODH, WA3DJT, WB2FCB, W2YHH, VE3FOB, WA8CZE, K1SYB, K2RDJ, K1MVB, K8HGY, K3UTL, W8QJC, WA2LVE, YS1MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3KT, Moral: It's the antenna that counts!

FLASH! Switched to 15 c.w. and worked KZ5IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5CLK, OZ4H, and over a thousand other stations!

V40 vertical for 40, 20, 15, 10,	
6 meters	\$14.95
V80 vertical for 80, 75, 40, 20, 15,	
10, 6 meters	\$16.95
V160 vertical for 160, 80, 75, 40, 20,	
15, 10, 6 meters	\$18.95

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W0W0X

**SWAN 500
TRANSCEIVER**
(Less Accessories)

\$495
(\$24 Monthly)



**80-10 Meter
Transceiver**

Here are some of the SWAN 500's deluxe features:

- Single Side Band/CW/AM
- Rated at 480 watts SSB, 360 watts CW, 125 watts AM.
- Selectible SB • ANL
- Calibrator

Larry Meyerson of World Radio Laboratories, Says —

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MOBILE
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A Deluxe Mobile Station — includes the "automatic" Swan #55 antenna; bumper mount; 25' coax; DC supply; mobile speaker. All plugs and cables furnished.

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ZZA128
(\$32 monthly)

**—OR BUY IT AS
A FIXED STATION
PACKAGE—**

A Deluxe fixed station with "red hot" performance! Includes Hy-Gain 5BDQ five band doublet antenna; 100' RG8/U coax; Swan 117XC 117-VAC supply speaker console; WRL SB44 dynamic microphone, all plugs and cables.

\$623²⁸
(\$30 monthly)

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ZZA120

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☐ Enclosed is my Money Order ☐ Check ☐ Charge it
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Hearty season's greetings and most
sincere wishes for good hunting



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